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# Surgery, Gynecology and Obstetrics

WITH

## International Abstract of Surgery

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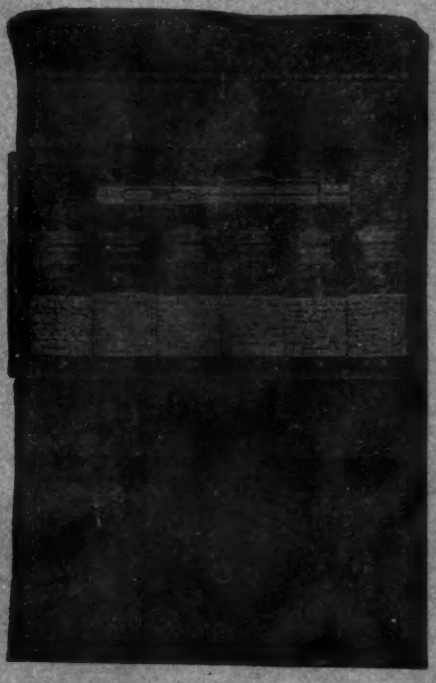

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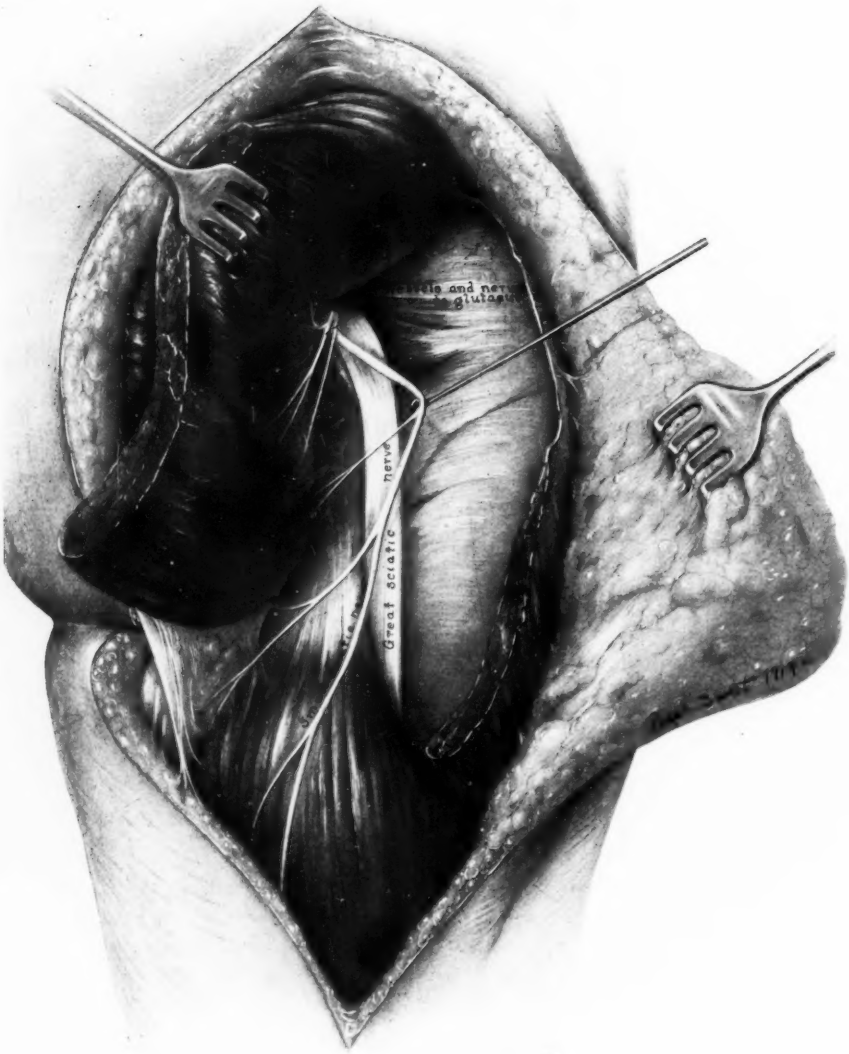


Fig. 5. Sciatic nerve. High exposure.

*Methods to Secure End-to-End Suture of Peripheral Nerves.— Howard C. Naffziger*

# SURGERY, GYNECOLOGY AND OBSTETRICS

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## METHODS TO SECURE END-TO-END SUTURE OF PERIPHERAL NERVES


BY HOWARD C. NAFFZIGER, M.D., SAN FRANCISCO, CALIFORNIA

From the Department of Surgery, University of California Hospital


END-TO-END suture of divided peripheral nerves is the aim of the surgeon in those cases of nerve division which come to operation. Cases presenting loss of considerable length of nerve have long been a problem. Endless methods of filling in these gaps have been recommended by surgeons and in large part have resulted in connecting the severed nerve ends by a material not penetrable by the neurones. The experimental works of Huber, Nageotte, and others in the use of free nerve grafts have pointed the way to a more rational treatment. The numerous ill-advised and physiologically unsound but ingenious devices which fill the literature have been replaced by a method having a sound experimental basis.

In our experience, however, and with improvement in operative procedures, the necessity for grafts has become less and less, while end-to-end suture has become more often possible. From the U. S. Army Letterman General Hospital, the neurosurgical service of the University of California Hospital and from other sources, largely industrial, over one hundred cases of peripheral nerve injury have come to operation within the past 18 months. From the large war experiences it would seem that in nerve surgery, the greatest advance has been made in methods of securing end-to-end suture. But comparatively little emphasis has been given to these methods of securing end-to-end suture when the gap is considerable. Increased experience has shown that even after war injuries which in general show a loss of a greater portion of nerve than following civil injuries, only a very small percentage can not be sutured end-to-end. It is of interest to note that in the first 10 cases of this series, two main trunks were considered to have gaps too great for end-to-end suture. In these, "auto cable grafts"[1] were used. In the later cases no grafts for the main nerve trunks were used. End-to-end suture was obtained in all at either a one or two stage operation. In addition, one of the earlier grafted cases was again operated upon, the graft removed and end-to-end suture obtained. We believe that auto nerve grafts, homo grafts, or hetero grafts should be reserved for those cases in which all methods of securing the direct suture have been exhausted. Apparently it is not an uncommon procedure for surgeons to resect bones of the extremities to secure shortening in order that they may obtain end-to-end suture. We feel that conditions justifying this must be most rare. In lesions of the large nerve trunks of the extremities—the ulnar, median, musculospiral, the great sciatic and its internal and external popliteal divisions, it is rare that end-to-end suture cannot be obtained. The vast majority of nerve wounds involve these trunks rather than their smaller sub-

[1] "Cable graft" is applied to free nerve grafts when several strands of nerve are used.

divisions. It is our feeling that free nerve grafting from the same individual is the most rational method of filling unbridgeable gaps but that resort to it should be made only after all methods of obtaining end-to-end suture have proved ineffectual.

Of the methods we have found most useful in obtaining apposition of the divided nerve ends are:

1. Free mobilization of the proximal and distal portions of the nerve.
2. Transposition of the nerve to a shorter route than the normal one.
3. Favorable posture of the extremity to shorten the distance to be overcome.
4. Gradual lengthening of the nerve by a two-stage operation.

### FREE MOBILIZATION OF THE PROXIMAL AND DISTAL PORTIONS OF THE NERVE

Free mobilization of the nerve requires above all, long incisions. Small incisions and forcible stretching of the nerve produces unnecessary trauma and does not secure the greatest lengthening. The attachments of the nerve sheath to surrounding fascia will not be freed by pulling. It is often found that free mobility is prevented by small nerve branches to muscles. Careful exposure of these and gentle dissection of them for some distance up the nerve trunk will be necessary before the desired freedom of movement is obtained. To secure the requisite mobility of nerve trunks, the exposure frequently must include great lengths. For the musculospiral nerve this may require an incision from the middle of the outer side of the arm down the upper forearm, with a second incision on the inner side of the arm exposing the nerve in its upper third and well up into the axilla. To free the ulnar nerve properly, even longer incisions over the course of the nerve may be required. For lesions of the great sciatic in the thigh or its branches in the popliteal space an incision from the gluteal fold to the knee is the rule rather than the exception. The long incision has additional advantages in obtaining greater delicacy of handling and permitting easier orientation when dealing with massive scars and distortion of normal anatomical relations. Wide dissection of the deep fascia from underlying muscle is most helpful in locating the lines of cleavage along intermuscular planes and in securing land marks. Varying the tension on muscle by flexion of the neighboring joints may facilitate dissection from nerve or scar and aid retraction. Recognition of small muscular branches is aided and careless sacrifices of them prevented. In dealing with large cicatrices much time may be lost in a search for the nerve if it is approached directly. A long incision—identification of the distal and proximal portions of the nerve in their normal relations above and below the scar—is the first step. After this a knowledge of the branches normally between these points will permit of more careful and rapid dissection of the scar without a division of intact branches or of the main trunk itself. After freeing the involved area, the condition of the nerve will determine the further operative procedure. When suture is to be performed and mobilization of the nerve is desired, gentle traction on the scarred ends will show the points of attachment of the nerve sheath which can then be freed by sharp dissection. Frequently short muscular branches will hamper the movement of the main trunk. With a fine, very sharp scalpel and slight traction, the line of cleavage at the junction of the branch with the nerve trunk can be followed for considerable distances without difficulty. This procedure does not cause even temporary interference in the function of these branches. This may be shown on the day following operation by voluntary power in the muscles supplied. It has frequently been observed after lesions of the ulnar nerve below the branches to the flexor carpi ulnaris and the inner heads of the flexor profundus digitorum. The day following the dissection unimpaired power in these muscles can be shown. The lack of interference with function is also seen in lesions of the lower sciatic after its branches to the hamstrings have been dissected up. Freeing of the fascial attachments of the nerve sheath from its bed and this method of lengthening muscular branches is completed for both the proximal and distal portions of the nerve. It is unwise at this stage completely to resect the scar tissue at the point of injury. By dis-

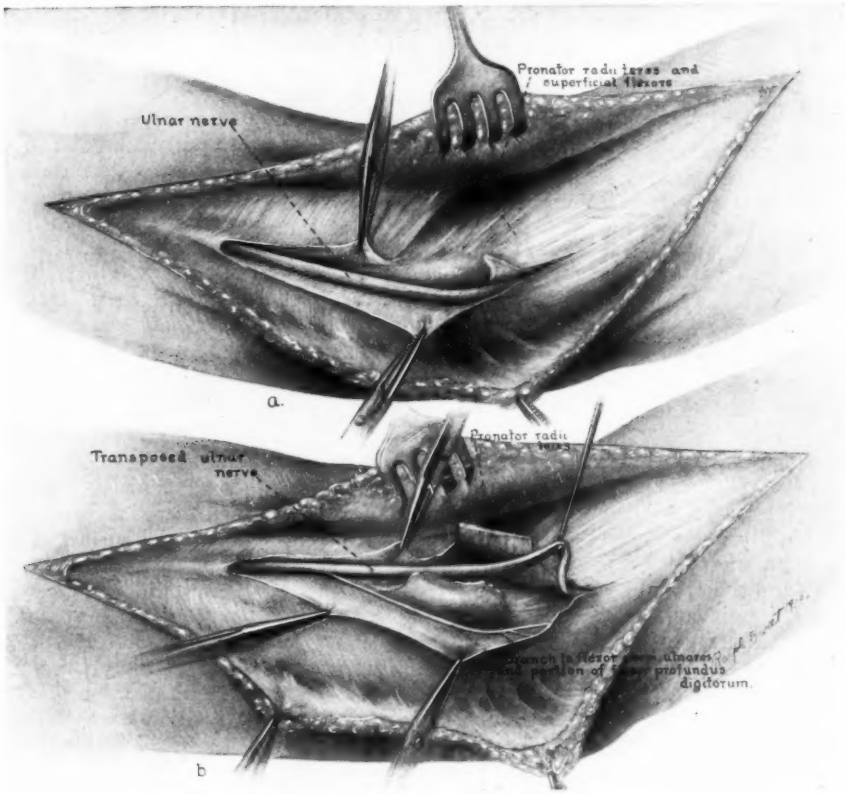


Fig. 1. Ulnar nerve. *a*. Normal route; *b*, transposed route.

section of surrounding scar from parts of the nerve trunk not invaded, by electrical stimulation, and by incision into the scar, one may supplement the information previously gained from clinical examinations and obtain an idea of the amount of resection necessary. With complete anatomical and physiological interruption one may judge the approximate length of the gap to be overcome.

### TRANSPOSITION OF THE NERVE TO A SHORTER ROUTE THAN THE NORMAL ONE

*Ulnar nerve.* In the case of the ulnar nerve, no branches are given off in the arm. About 2½ or 3 inches above the internal condyle of the humerus, the ulnar nerve perforates the internal intermuscular septum and comes to lie behind it. It then passes downward behind the condyle, in the ulnar groove. Just below the condyle its branches to the flexor carpi ulnaris and the inner heads of the flexor profundus digitorum are given off. There are no further branches until about the middle of the forearm where a small branch passes to the ulnar artery. Below this and about two inches above the styloid process of the ulna, the dorsal cutaneous branch is given off. By transplanting the ulnar nerve at the elbow from behind the condyle to the flexor surface in the bend of the elbow, the route is slightly shortened and a gain is made. It should be noted that to secure the greatest mobility, it is necessary to extend the incision sufficiently far to free the nerve well above and at the point where it pierces the internal intermuscular septum. In cases of ulnar paralysis we do

not feel it is justifiable to sacrifice the branches to the long flexors when transposing the nerve. It is possible and not difficult with a small, sharp knife to dissect these branches away from the main trunk for a considerable distance. By placing the nerve under slight tension one can follow the line of cleavage of the fibers. The muscle branches are then of sufficient length to follow the normal anatomical route of the ulnar nerve, even though the main trunk is placed in front of the condyle. It has seemed more satisfactory in changing the position of the ulnar nerve to place it beneath a covering of the deep fascia and muscles and to give it an absolutely straight route. After dissection of the superficial fascia away from the deep fascia, the upper margin of the pronator radii teres is identified. With a small incision along its upper margin close to the internal condyle, it is possible to elevate it slightly and locate the plane upon which the ulnar nerve is to lie. The superficial flexors and the pronator are cut through close to their origin at the internal condyle and reflected (Fig. 1, *a* and *b*).

There is no natural line of cleavage between these muscles and the deep flexors. An incision through the deep fascia and the superficial muscles will permit them to be split back a few centimeters from their origin. This separation requires a short incision in the intermuscular aponeurotic fascia. The branches of the median nerve to the pronator are on the inner side and are not jeopardized. The ulnar nerve is placed beneath the reflected muscles which are then sutured in place. The deep fascia from above the site of former perforation of the internal intermuscular septum is then sutured over the nerve. A more simple procedure is to transplant the ulnar nerve to a position in front of the condyle but not to bring it beneath the deep fascia and muscles. In such a position, however, it can be felt close beneath the skin and is not infrequently tender. Another method is to cut only the attachment of the long ulnar flexors. Our results following transposition beneath the muscles have been entirely satisfactory. On the following day with lesions distal to these branches, voluntary power in the long flexors supplied by the ulnar nerve can be readily demonstrated, showing that the dissection of the muscle branches from the main nerve trunk has in no way interfered with their function.

*Musculospiral nerve* (Fig. 2, *a* and *b*). Lesions of the musculospiral nerve are frequent and the results have excited frequent comment as perhaps being better with lesions of this than with lesions of the other peripheral nerves. The nerve is more commonly injured in the lower half of the arm than in the upper. Fortunately, with lesions of the musculospiral much can be gained by altering the position of the arm and gaps which often times at first sight might seem impossible to lessen sufficiently for an end-to-end suture can be overcome. In certain instances, transposition of the nerve to a position in front of the humerus is desirable and is particularly applicable to those cases in which there has been an extensive injury to the posterior surface of the arm with a large amount of scar involving the triceps and the posterior surface of the humerus. The transposition, however, can be used when the injury is at other locations. For the transposition two incisions are necessary. In the lower half of the arm the nerve is exposed by an incision on the outer side, extending downward in the bend of the elbow to the mesial side of the external condyle. The second incision is made over the brachial sheath in the upper half of the arm on the inner side. With an external incision alone it is impossible to bridge very considerable gaps by dissecting the nerve free and mobilizing it down to its terminal branches in the forearm. The branch to the supinator longus is not sacrificed, but may be dissected up for a short distance. Through the external incision it is possible to follow the lower half of the nerve well up along the musculospiral groove and mobilize it. This procedure permits of a surprising amount of gain. A second incision may be made over the brachial sheath in the upper third of the arm. The musculospiral is exposed at the lower margin of the teres major where it passes behind the humerus and between it and the long head of the triceps (Fig. 3, *a* and *b*).

The long branches of the musculospiral to the triceps are in full view and if necessary can

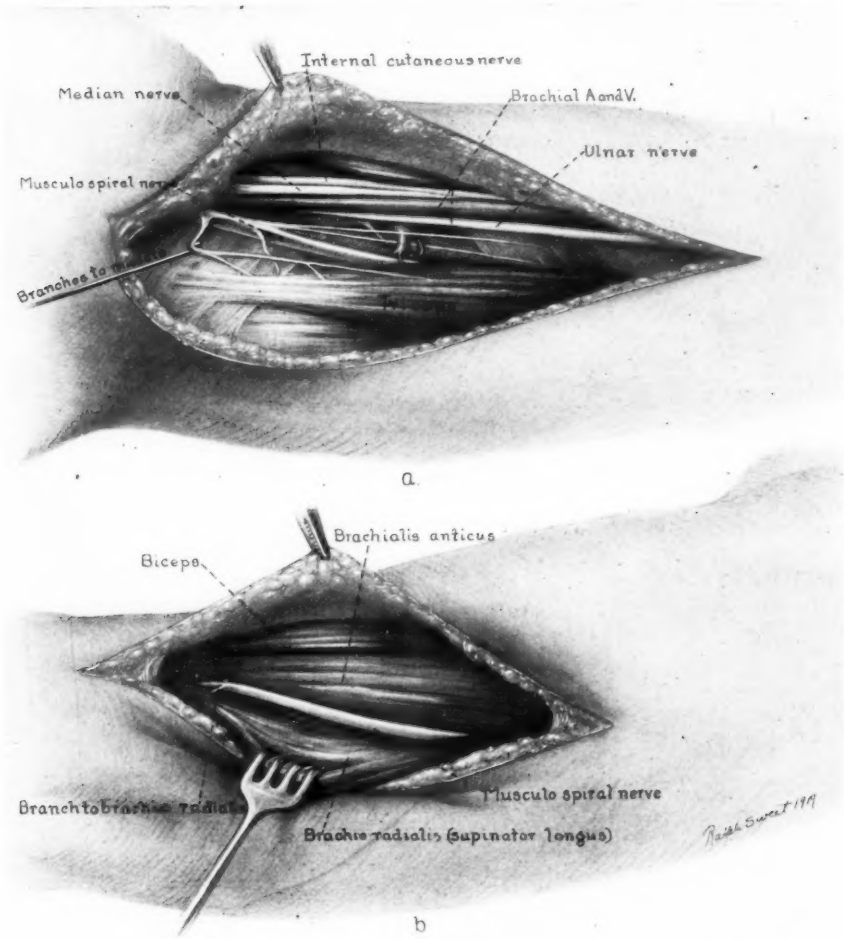


Fig. 2. Musculospiral nerve. *a*, Normal relations in lower axilla; *b*, normal relations in lower arm.

be dissected up for some distance along the course of the nerve. The nerve is then brought out of the musculospiral groove and is passed behind and to the outer side of the axillary vessels and the median and ulnar nerves. The biceps is then dissected free so that an oblique position of the musculospiral is permitted beneath it. The nerve then runs directly from the axilla in front of the humerus, lying beneath the biceps and emerging about 2½ inches above the lower end of the humerus on the outer side. The branches to the outer head of the triceps are sacrificed. Such a transposition does not give a great gain but it does permit of a slight one and in addition the arm can also be placed in a more favorable position to make a gain from adduction, flexion, and internal rotation at the shoulder with flexion at the elbow.

*Median nerve.* The median nerve takes a more direct course than either the ulnar or musculospiral nerve. Some lengthening may

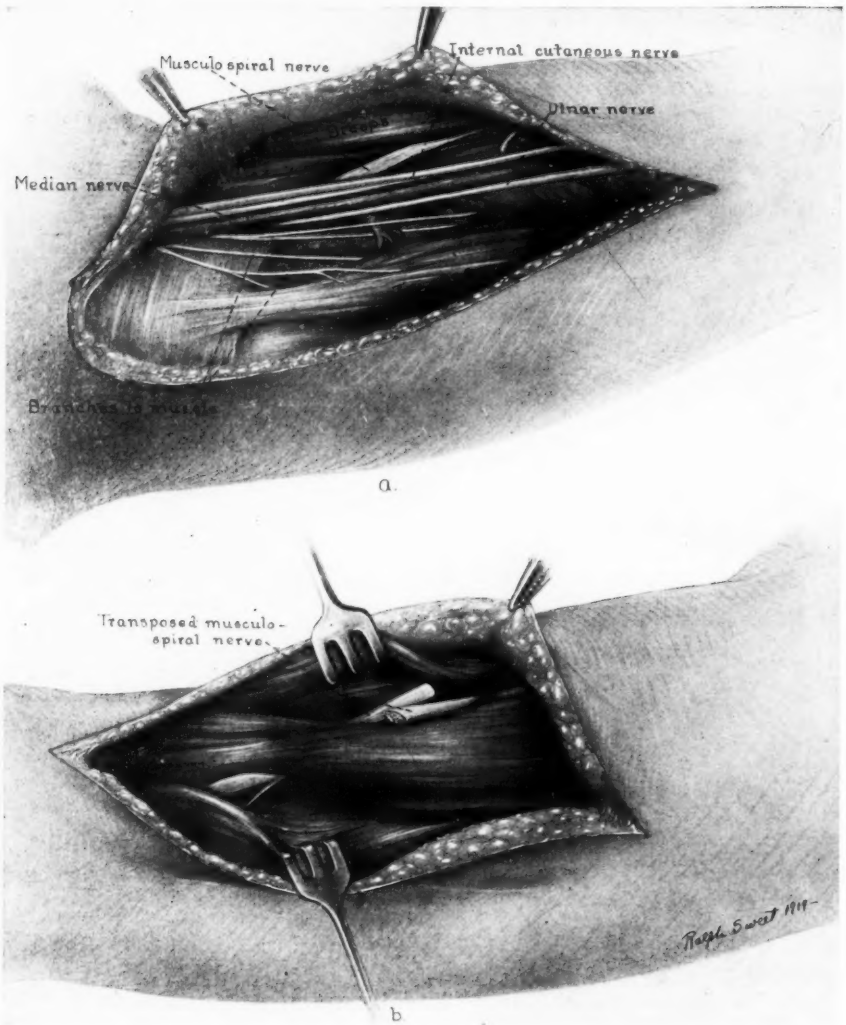


Fig. 3. Musculospiral nerve. *a*, Transposed route, upper arm; *b*, transposed route, lower arm.

be obtained by dissection upward of the muscular branches in the upper forearm and transposition to a more superficial position.

*Sciatic and internal and external popliteal nerves.* In the lower extremity the course of the sciatic is such that a shorter course can not be obtained by transposition. This also applies to the two subdivisions of the sciatic.

### FAVORABLE POSTURE OF THE EXTREMITY TO SHORTEN THE DISTANCE TO BE OVERCOME

It is fortunate that the main nerve trunks in the extremities lie for the most part on the protected flexor surfaces. When this is not the normal position of the nerve throughout its entire course as in the musculospiral and ulnar nerve this favorable location can be

obtained by transposition. Owing to this favorable circumstance, flexion of certain joints will relax the nerves and while in a position of flexion the distance bridged by the nerve will be shortened. An otherwise unbridgeable gap may be overcome and sutured end-to-end by flexion of neighboring joints.

*Ulnar nerve.* With the ulnar nerve the advantage from flexion at the elbow is obtained only after transferring the nerve from behind the internal condyle to an anterior position. An additional gain below is made by flexion of the wrist. This is particularly useful in lesions low in the forearm and hand. With lesions above the branches to the long ulnar flexors, flexion of the wrist is of little value, for while it relaxes the main ulnar trunk, these muscular branches restrict its movement above. Unless these are sacrificed, flexion of the wrist is of little value fors uch lesions. With the high injuries, flexion of the elbow and adduction of the arm to the side give the greatest gains. With high mobilization in the axilla, adduction and a forward position of the arm with full flexion at the elbow are used. It should be remembered that the usual position of the arm at right angles to the body and extended as during operation is an unfavorable one for suture.

*Musculospiral nerve.* With the musculospiral nerve free mobilization is of the utmost importance and next comes flexion of the elbow with the forearm in pronation. Some gain is made by adduction of the arm to the side. Carrying the elbow well forward on the chest still further shortens the distance from the axilla to the elbow. The greatest gain in lesions of the musculospiral has been obtained by extensive mobilization through both the inner and outer incisions, transpositions of the nerve to the front of the humerus followed by full flexion at the elbow with easy pronation of the hand. Also the elbow is carried well in front of the chest and elevated, with the upper arm in internal rotation and the forearm resting on the chest.

*Median nerve.* With the median nerve, the same postures are used. Wrist flexion in low lesions, elbow flexion, adduction of the arm, a forward position of the elbow and elevation of it for higher injuries.

Fig. 4. Line of incision for high exposure of sciatic nerve.

*Sciatic nerve.* The sciatic nerve gaps are slightly lessened by full extension at the hip and a position mid-way between adduction and abduction but the great gain is obtained by full flexion of the knee. The same positions are most favorable in overcoming gaps in either the internal or external divisions of this nerve. For high lesions of the great sciatic the following procedure has appeared to us most satisfactory; it gives complete exposure up to and well into the sciatic notch. No nerves or other important structures are cut. On the posterior surface of the thigh, a mid-line incision is made over the course of the nerve. The upper end of it lies at the gluteal fold, mid-way between the ischial tuberosity and the great trochanter of the femur. The portion of the incision over the buttocks is convex outward, the lower end

meeting the upper end of the straight incision (Fig. 4). The superficial fascia and skin are dissected well back to the trochanter on the outer side and the gluteus maximus is cut at its insertion or separated subperiosteally. The muscle is then reflected toward the midline and the entire course of the sciatic nerve from the pelvis is uncovered. The margins of the sciatic notch are exposed. With this exposure we have been able to perform suture in intrapelvic division of the nerve, about 2 centimeters inside the sciatic notch. The vessels to the gluteus maximus as well as its nerve supply reflect with the muscle to the median side (Fig. 5). At the close of the operation the muscle is accurately sutured in place with a few chromic gut sutures and also the pyriformis if it has been cut. There is no interference to the return of function in the gluteus maximus. For the suture of the sciatic in the thigh and likewise for the internal and external popliteal nerves, free mobilization down to the terminal branches of the main trunks is obtained. Following this, full flexion of the knee usually permits the suture to be made.

### GRADUAL LENGTHENING OF THE NERVE BY A TWO-STAGE OPERATION

In a small number of cases in which an end-to-end suture can not be obtained at a one stage operation it has been in our experience a more satisfactory procedure to do a second stage operation rather than to resort at once to a nerve graft. After using all the means at our command if it is obvious that after complete resection of the neuromata and the scar, end-to-end suture can not be obtained the following plan has been adopted. The fibrous ends of the proximal and distal nerves are overlapped as far as possible taking advantage of all gains from favoring posture. The fibrous ends are not resected but sutured firmly together in this overlapped position and the wound is closed. The posture of the extremity is maintained by cast or splints; later, gradual extension of the part is permitted until there is normal freedom of movement and the normal range of motion is acquired. At the second stage operation which is usually not performed before 2 months after the first, the suture is accomplished. The scarred portion is resected. The part is again put in a favoring posture and end-to-end suture performed as in a one stage operation (Fig. 6, *d*).

The question arises as to the result on the nerve of this lengthening process following the first stage operation. At the second stage it is found that the nerve above and below the lesion shows some attenuation and some decrease in the size of the bundles above and below. Upon section, however, the nerve is vascular and the final test is in the regeneration. In nerves sutured in two stages satisfactory regeneration has occurred. Our results have been much better than after auto cable grafts.

### NERVE SUTURE

Many technical details have been emphasized with regard to the exact method of nerve suture. The essentials are delicacy of handling and the avoidance of trauma, accurate suturing without tension, with the use of a minimum amount of foreign material to favor the production of fibrous tissue, and the proper protection of the parts afterward. In recent years much has been written as to the details of arrangement of nerve bundles in the various nerves, and we consider it of importance to avoid any rotation of the nerve during suture. It is recognized in the detailed anatomy of nerves that certain bundles occupy a definite, fixed, and fairly constant position in the nerve. If in suturing a divided nerve, it is rotated, it may be that bundles of sensory nerves are approximated to motor tracts in the distal portion. Even in the event of regeneration in such a case as this, motor neurons from the proximal segment could not be expected to supply fibers to the tract below. Likewise, sensory neurons above could not be expected to supply the stimulus necessary for muscular contraction. When the musculospiral nerve, which contains few sensory fibers, is sutured even if it is rotated, most of the motor neurons will still be in contact with motor tracts. There are fewer opportunities, then, for them to go astray. This may explain the fact that better results are secured after suture of the musculospiral nerve than

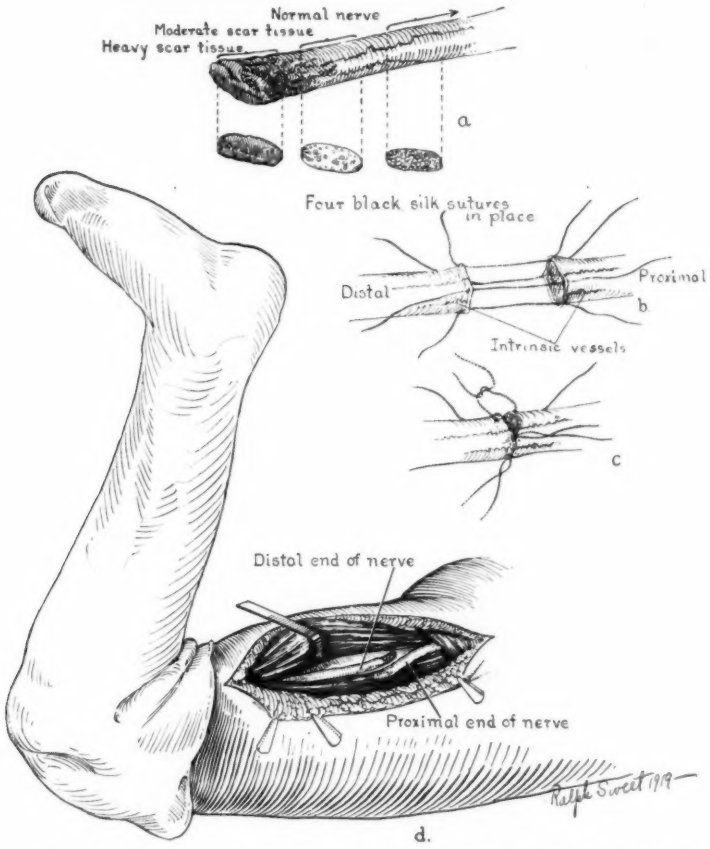


Fig. 6. Sciatic nerve. *a*, Sections of neuroma; *b*, sutures in place; *c*, Sutures tied; *d*, gap overcome by knee flexion.

after the suture of other nerves. With this idea in mind, we have endeavored in suturing nerves to avoid rotation. The nerves are found frequently rotated in the scar tissue to which they are attached. It may be very difficult to determine their correct position but by careful attention to vessels of the nerve, it may be possible to match them with a fair degree of accuracy. Many of the complicated details of nerve suture seem to defeat their object by favoring the production of an increased amount of fibrous tissue. In the exposure and handling of the nerve, freedom from trauma is obtained by exposure of the nerve well above and below the site of lesion. Delicate handling of the nerve is of first importance and compression or traction are to be avoided. When handling is necessary the sheath only should be grasped. While the proximal and distal portions of the nerve are still lying in place, close observation may enable one to match vessels of the proximal and distal portions. Prior to resection of the neuroma, it is well to have landmarks to guide one in a later suture. Fine silk sutures can be used as markers. A small amount of nerve sheath can be picked up in this way. In introducing the needle into the sheath, the suture should be placed in the long axis of the nerve and not transversely on account of the

lessened risk of injury to the fibers. The neuroma is sectioned serially with a sharp knife, beginning at its most dense portion. Each successive section is closer to normal nerve. It should be unnecessary to state that scissors should not be used in cutting nerve tissue on account of the crushing involved. Upon sectioning through dense scar, the tissue is dead-white, very fibrous, and shows no cut nerves and bleeds little or none at all. As successive sections are made it becomes more vascular and occasionally a small, rather white cut end of a nerve is seen. These increase as normal nerve is approached. It is usually not difficult to determine when we have reached a nerve that is entirely free from fibrous tissue (Fig. 6, *a*). On the proximal side of the injury such a nerve presents a succulent, rather œdematous appearance; the ends of the nerve bundles protrude slightly and are soft in appearance and the nerve bleeds freely, usually showing a spurting artery. Sponging of the cut nerve ends is to be avoided; for this purpose, when necessary, cotton satured with warm Ringer's solution should be used. It is preferable to permit such a vessel to bleed until clotting occurs rather than to attempt sponging or clamping. To clamp a vessel in the substance of a nerve and tie it, only adds to fibrous tissue production. When bleeding has stopped, any adherent clot is readily removed by a small amount of Ringer's solution and a cotton sponge. Regarding the distal portion of the nerve, its appearance is quite different from the proximal. It is much smaller, both in its total bulk and in the size of the nerve bundles. Serial sections are made in the same way until normal distal nerve is reached. It is whiter than nerve above the lesion and the bundles are smaller and firmer. Although it bleeds freely, the vessels are neither as numerous nor as large as in the proximal portion. It must be handled in the same gentle way as the upper segment. The guy sutures previously placed give us our landmarks, so that we may avoid rotation. A few fine silk sutures are then placed, usually four in number. These sutures take in only the sheath of the proximal and distal portions (Fig. 6, *b*). We have preferred simple sutures, as less tissue is strangulated when they are tied. No detail which will lessen the scar production is insignificant. After these sutures are placed, the limb is brought into a favorable position for approximation and the sutures are tied (Fig. 6, *c*). It should be noted that a tight suture which includes too much of the sheath will bring the cut nerve ends too close together and cause them to be forced outward as a brush. The nerve bundles should barely come in contact. They should not be brought tightly together. The last remnants of any clot present are removed just before tying the sutures. The sutures used are of the finest silk. If the approximation of the sheath is not exact, additional sutures may be placed. Even with a nerve as large as the sciatic, more than seven or eight sutures are seldom required. Sutures are not to be relied upon to stand any great tension. Proper mobilization of the nerve should permit one to estimate the amount of the tension there will be. If the ends of the nerve can not be readily brought together and held with the lightest suture, accurate approximation can not be obtained. It has been remarkable to note that after a suture has been made with joints in the most favorable posture some lengthening of the nerve occurs rapidly. The joints will rarely need to be splinted in the extreme position in which they are held during the suture. It has happened in two instances that extremities have been straightened within 24 hours following suture. In neither of these did the nerve ends pull apart. Such a procedure is not to be recommended, but it throws some light on the possibilities of the gradual lengthening of nerves.

### PROTECTION OF THE SUTURE LINE

The literature has been filled with various devices for protecting the line of nerve suture against the invasion of fibrous tissue. Foreign materials have in general opinion been less desirable than an auto graft of fat or fascia. We have considered that any foreign material or any free graft favors the production of fibrous tissue. Transplanted fat becomes fibrous. We feel that the most desirable bed for a line of nerve suture is against the uninjured muscle and preferably between muscle planes. Upon re-exposure of a nerve in which the line

of suture has been so placed, the condition has been most satisfactory. A free dissection of scar tissue at the time of operation and the covering over of raw surfaces has been practiced. Even pedicled flaps of fat, fascia, or muscle may cause some scar contraction. A recent case gave a history of a tender ulnar nerve at the internal condyle with impaired use of the hand. Two years before, after a slight blow and with no bone injury, his ulnar nerve had been found to dislocate readily. It was operated upon and fastened in place by surrounding it with a pedicled flap of deep fascia. When coming to us the function of the nerve was impaired about 50 per cent and the ulnar area was anæsthetic. At operation the fibrous investment was found to have constricted the nerve and was too firmly attached to it to permit of its complete removal. A neurolysis and transposition of the nerve was done. Such results make one chary of the degree of protection offered by partially vascularized or avascular tissue. Under the impression that it is of some value we have used heat and gentle massage of the operative wounds over the site of nerve suture soon after wound healing has occurred.

More complicated intraneural methods of suture have their advocates, but are apt to defeat their object. Many prefer at least one through-and-through suture of catgut. This may be advisable in exceptional cases but we have felt that equally good approximation and less trauma was produced by careful suturing of the neurilemma only. Freedom from tension and avoidance of those factors which increase scar-tissue production and neuroma formation are the essentials.

### AFTER-TREATMENT

The length of time in which a favoring posture of the extremity must be maintained after nerve suture varies widely in the opinion of various surgeons. Of necessity it varies with the length of the nerve gap overcome and the degree of tension. The period should be considerably longer after a two-stage operation than after a single stage operation. There are other factors to be considered. Certain alterations in the position of a joint are of less importance than others. In the lower extremity the position of the hip whether in abduction or adduction is of less importance than to prevent flexion at the hip or extension at the knee. In the upper extremity the forward position of the elbow on the chest is less important than the maintenance of flexion of the elbow. Likewise certain cases will demand less extreme joint positions. With the sciatic nerve and its divisions only partial flexion at the knee may be necessary. While the importance of certain elements in the posture of the parts varies, it has been our custom to maintain the position found necessary at operation for a period of 5 or 6 weeks. After this time gradual adjustments are permitted and about 1 month more is consumed before full range of movement is permitted. Considerable latitude must be allowed depending upon the requirements of the particular case. Immediately following operation a plaster-of-Paris spica for the lower extremity has been found most satisfactory to maintain extension and moderate abduction at the hip flexion at the knee and to support the foot. If the knee is not in a position of full flexion, the posterior portion of the cast is, in a few days, removed from the mid-thigh to the foot. This permits of massage and a change in the degree of flexion at the knee obviating joint stiffness and further atrophies. After daily massage and movement, the leg and foot are re-bandaged to the shell of the cast. With the upper extremity, plaster of Paris has been used only to maintain full flexion at the wrist. For preserving the correct attitude at the elbow and shoulder, soft dressings and starch bandages have been efficient and comfortable. They are applied in some such fashion as the Velpeau bandage. Movements of the joints within the permitted range and massage are continued until the normal position of the part is resumed and are continued with all other aids during the entire period of nerve regeneration. Casts or splints not readily removable are avoided as favoring atrophies and joint stiffness.

### LENGTH OF NERVE GAPS

Injuries of the main nerve trunks of the upper and lower extremities are more frequent than injuries of their subdivisions. With rare

exceptions, the repair of them can be made by end-to-end suture. A much smaller number of peripheral nerve injuries occur to the subdivisions of the main trunks. Often in association with these are extensive injuries to muscles and tendons and consequently large scars. With the smaller nerves similar methods of operative procedure usually permit of nerve suture. The proportion, however, which will require nerve grafts is larger than with injuries of the main trunks, for less gain can be made by mobilization, transposition, and posture. By the use of nerve grafts from the same individual, we have secured regeneration through a graft 10 centimeters in length with consequent improvement in sensation and a return of voluntary power in the muscles supplied. This return of voluntary power, however, while permitting of a considerable range of movement, was quantitatively too weak to be called a satisfactory functional result. In this particular case after the better development of our methods, we were able to excise this graft and secure end-to-end suture.

We recognize and appreciate the value of the nerve graft in cases where end-to-end suture can not be obtained. Such cases, however, are in small proportion and resort to graft should be made only after all attempts at end-to-end suture have been unsuccessful.

From operative experiences and from anatomical studies and measurements, we consider the following figures represent an average of the distances which may be bridged.

*For the ulnar nerve*, mobilization alone permits of suture after a 3 centimeter gap; after mobilization and transposition 4.5 centimeters. Adduction of the arm to the side permits a slight additional gain; with mobilization, transposition, adduction, and complete flexion of elbow and wrist, 10 centimeters.

*For the musculospiral nerve*, mobilization alone permits 2 centimeters; mobilization with elbow flexion, 8 centimeters; with mobilization, elbow flexion and adduction, slightly more, usually about 8.5 centimeters; mobilization, transposition, elbow flexion and adduction, 10 centimeters.

*For the median nerve*, mobilization 2 centimeters; mobilization, adduction and elbow flexion, 9 centimeters.

*For the sciatic nerve, and the internal and external popliteal trunks*, mobilization 3 centimeters, mobilization, extension at the hip and flexion at the knee 9.5 to 10 centimeters.

These figures represent distances which may be bridged at one stage operations. With two stage performances, additional gains may be made.

A large number of our cases of nerve division have received their injuries in war. The difficulties of securing end-to-end suture are greater than after the injuries in civil life owing to the more extensive loss of tissue. In certain cases we feel that free nerve grafts offer the best prospect of a satisfactory result. In others as after the loss of many small muscular branches or with extensive muscle and tendon injuries, tendon transplantation, arthrodesis or some permanent splint should be considered. Fortunately it is not often that resort to these must be made. End-to-end suture is the method of choice and with few exceptions can be obtained. This is particularly true of the main nerve trunks. Familiarity with these methods in peripheral nerve surgery gives an increasingly high proportion of end-to-end suture.

# CHEMICAL INFLUENCE OF THE ACTIVE CONSTITUENTS OF THE DUCTLESS GLANDS[1]

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EACH ductless gland elaborates one or more definite chemical substances which is contained within its specific secretion. In order to understand the chemical processes resulting from the activity of the ductless glands, it is the duty of the chemist first to separate and then to identify each of the definite chemical substances which are produced by the various glands. So far the chemical investigation of the glands has resulted in the isolation of only two of the active constituents.

The active constituent of the adrenal medulla was investigated in 1901 by three chemists, Abel, Takamine, and Aldrich. Abel separated the benzoyl derivative of a substance which he named epinephrin, meaning the active constituent of the adrenal. Due to the work of Takamine, epinephrin, or adrenalin, as he named it, was made commercially available. Epinephrin is a distinctly crystalline substance, which possesses a definite chemical composition and its exact nature is so well known that it has been synthesized from simple organic chemicals and can be prepared at a moderate cost. Epinephrin can be prepared from the gland in a very simple manner. The proteins of the gland are first coagulated by boiling in dilute acid. The epinephrin is left as a soluble salt in the water and all the proteins are precipitated. The solution is concentrated and the epinephrin is precipitated in crystalline form by the addition of ammonia.

The second gland the secretion of which has been identified by the chemist is the thyroid. The thyroid has long been known to contain iodine. In 1914, I separated the iodine-containing compound of the thyroid in pure crystalline form (3). Since that time its identification has been accomplished and a great deal of work has been carried out in our laboratories concerning the exact chemical properties of this compound, which has been named thyroxin (4, 5).

Thyroxin is a white crystalline substance which has the properties of a very weak acid. It is extremely insoluble in water, about one part in one million parts of water, but it is readily soluble in sodium hydroxid. The most striking characteristic of thyroxin is its iodine content. The substance contains 65 per cent of iodine, which is very firmly attached to the organic nucleus and is not easily broken off with sodium hydroxid, although it is very easily broken off by the action of sunlight.

The preparation of thyroxin from the thyroid gland is much more difficult than the separation of epinephrin from the adrenal. Thyroxin is combined as an integral part of the protein molecule and before any attempt at separation can be carried out it must first be liberated. This is accomplished by boiling the entire gland in 5 per cent sodium hydroxid. The proteins are destroyed and when acid is added practically everything is held in solution except the thyroxin. Thyroxin is extremely insoluble in acids and the first impure precipitation with acid contains approximately 10 per cent of iodine, although the original fresh gland contains only 0.04 per cent, that is, the thyroxin is 250 times more concentrated in this precipitate than it is in the gland. Although this step is simple, to prepare pure crystalline thyroxin from the first impure precipitation is not an easy matter. However, it may be accomplished with a fair yield by taking advantage of the insolubility of thyroxin in alcohol, and the fact that the impurities form salts with barium.

Although the active constituent of the posterior lobe of the pituitary has not been isolated, in some respects its action resembles that of histamine. This resemblance is not a proof of the identity of the substance, and the exact nature of this portion of the pituitary is unknown. The anterior lobe of the pituitary appears to be related to the phenomenon of growth. Robertson has separated a mixture of substances which he claims affects the

[1] Presented before the Clinical Congress of the American College of Surgeons, Montreal, October, 1920.

growth of small animals, but he has not carried this investigation to completion.

The active constituents of the other ductless glands are known only through the effects they produce when administered to normal animals or by the effects following their extirpation, and it is mere speculation to ascribe to these glands any action which can be expressed in chemical terms. Chemically they are unknown substances.

The feeding experiments with the other ductless glands have led to interesting results which find some application in clinical medicine. Definite progress will not result from "shotgun" administration of varying mixtures of these glands, but will come only after the actual isolation and identification of the active constituents of each one.

Although the exact chemical structure of epinephrin has been known for about 18 years, this knowledge has not directly assisted in an explanation of the chemical reactions which follow its administration. Just why this particular configuration should be physiologically active is unknown. That the activity is dependent on the precise arrangement of the groups within the molecule is proved by the preparation of the optical isomer of epinephrin.

During the course of the synthetic preparation of epinephrin equal amounts of so-called right-handed and left-handed epinephrin are produced. Only the left-handed form is found in the body, and although the two compounds have the same chemical composition, they do not show equal physiological activities. The left-handed form possesses fifteen times the physiological activity of the right-handed. It is therefore necessary to separate the two forms. This can be accomplished readily, and it is then found that the left-handed form possesses identical physiological activity with the natural substance. It would appear that this specific chemical structure of epinephrin fits some chemical mechanism within the body as a key fits a lock. Any deviation from the exact configuration destroys its effect.

When epinephrin is administered a long series of results follows. Apparently all physiological processes are altered. Some of the most obvious effects are on the blood pressure, the distribution of blood within the body, change in the rate of flow of blood through certain organs, the production of glycosuria, and a rise in the metabolic rate. The effect also varies with the dosage, a large amount producing in some cases the direct opposite of a small amount. The most characteristic action of epinephrin, however, is the immediate response to its administration and the very short duration of its action.

The active constituent of the thyroid has been known clinically for about 25 years and its effect on cretinism and myxœdema has been almost miraculous from the very first clinical application. Any substance supposed to be the active constituent of the thyroid must do all that desiccated thyroid will do. It may be stated in brief that thyroxin will bring about all the changes in the thyroid-deficient individual that are brought about by desiccated thyroid. Physiologically it has almost numberless effects. As with epinephrin, there seems to be no physiological process which is not influenced after injection of thyroxin.

For 19 years the only known chemical difference between the thyroid and the other glands of the body was the presence of iodine. For this reason all attempts to explain its physiological nature were based on our knowledge of what iodine and iodine-containing compounds will do. The isolation of the organic nucleus to which the iodine is attached of course simplifies the problem, but in another way it raises still more questions. That is to say, is it the idodine in the molecule or the organic nucleus which is responsible for the activity of thyroxin? This question can be answered only through the synthetic preparation of thyroxin, replacing the iodine with other groups, especially hydrogen, and the determination of the physiological activity of these compounds. Some of these substances have been prepared in our laboratories, but I cannot at this time report on their physiological significance.

Unless single, pure chemical substances are used the investigation of the chemical influence of the adrenal and thyroid is hopeless. This is illustrated by the large amount of work which has been done concerning the effect of the thyroid on the blood pressure. Some in-

vestigators have found that the blood pressure is increased by intravenous injection of extracts of the thyroid; others have found that it is decreased; and still others have found that it is not affected. When this experiment is tried with pure cyrstalline thyroxin it is found that there is no effect on the blood pressure and there is no marked physiological response immediately following the injection in a normal animal. The response does not begin until after several hours. Plummer has shown that the maximum effect is reached about the tenth day in the myxœdematous patient and that the definite physiological effect of a single injection of thyroxin is continued for at least 24 days.

The determination of the time relations of thyroxin illustrates how difficult it is to establish proper clinical use for an unknown substance such as desiccated thyroid. Since the amount given on any one day requires about 10 days to build up its full response, establishing an optimum dose for any individual requires weeks. When the correct dose is determined, it is possible to maintain a normal metabolic rate irrespective of the patient's rate when he began taking the thyroxin.

The exact relation between the basal metabolic rate and the amount of thyroxin administered suggests that some definite balance is maintained within the body between the amount of thyroxin circulating in the blood and that functionating in the tissues. This relation, of course, must be maintained by the proper activity of the gland.

Recently in our laboratory we have developed a method for the detection of iodine within the blood and tissues, and by this method we have shown that the normal iodine content of the blood is about 0.013 milligrams per 100 cubic centimeters. What percentage of this is in the form of thyroxin we do not know. However, it is almost all precipitated with the protein, showing that it is organically combined, and it is found in the plasma to a much greater extent than in the cells. These facts are in keeping with the hypothesis that most of the iodine of the blood stream is in the form of thyroxin. If we assume that 100 per cent of it is thyroxin, the thyroxin content of the blood would be one part in five million: the content of the tissues is slightly higher; furthermore, a most interesting seasonal variation has been determined. Seidell and Fenger have shown that the iodine content of the thyroid gland is much higher in summer than it is in winter. We have now shown that the iodine content of the tissues is much higher in winter than it is in summer. This suggests that the total amount in the body throughout the year is about constant, but in the winter it is thrown out to the tissues and is used to produce energy. In the summer less energy for heat is required and the thyroxin is held in the gland.

The physiological dose is from 1/50 to 1/75 milligram per kilo of bodyweight, yet when one thousand times as much as this is administered intravenously to a small dog there is only a slight passing effect, and 30 minutes after the injection the dog appears entirely normal. We had expected to produce a most violent reaction with this amount of the substance, but when almost no effect was produced we examined the distribution of the compound within the animal and found that one explanation of its failure to act is that it is excreted before it has time to function. There seems to be a very rigid control over the amount which the tissues can take up. The normal thyroid also absorbs but very small amounts of thyroxin. Since the tissues do not remove the substance from the blood stream and since the thyroid cannot store it, it is excreted in large amount through the liver and appears in the bile.

If the 200 milligrams administered had been divided into twenty 10 milligram doses, the animal would have died from a maximum degree of hyperthyroidism before the last amount had been injected. Typical symptoms of hyperthyroidism simulating those seen in toxic adenoma are produced by the administration of thyroxin.

These facts emphasize the great difference between epinephrin and thyroxin; the former acts instantly, thyroxin does not begin to function until after many hours and continues for about 3 weeks.

Whenever any physiological process is carried on by the animal organism, energy is

produced and expended. The source of the energy is the food taken in at the mouth. The process by which the food is assimilated and carried to the tissues is fairly well known, but very little is known concerning the mechanism by which it is oxidized to water and carbon dioxid after it has reached the tissues. We were assisted very materially, therefore, in picturing the function of the thyroid when Plummer showed that thyroxin increases the rate at which the body produces energy in mathematical relation to the amount given. The thyroid is used within the tissues to carry out chemical reactions which are closely related with the production of energy. Whether or not life is possible in the complete absence of thyroxin is not the first question to be answered. The important point is to establish the mechanism by which thyroxin functions. When this is done it will explain the fundamental chemical groupings which are used by the body for the production of energy. These same groupings then may be found in substances other than thyroxin. Viewed in this way thyroxin assumes a leading rôle in the body's mechanism to produce energy, and it seems not impossible that the other ductless glands fall into this plan, occupying positions of equal importance for certain other reactions, with this distinction, however, that the thyroid is involved in those reactions which probably result in the production of carbon dioxid. The other glands may be regarded as preparing metabolites for their subsequent reaction with thyroxin.

During catabolic processes certain nitrogen-containing substances result from what may be termed side reactions to the general course of metabolism. When these toxic nitrogen-containing compounds are formed severe symptoms are produced. It would seem necessary that the body be safeguarded from these effects. While we cannot say exactly at which point the parathyroid influences nitrogen metabolism, there is little doubt that it does influence it, protecting the body in some way from the production of guanidine and its derivatives.

When certain of the ductless glands are removed, notably the parathyroid and the adrenal, toxic symptoms develop and the animal dies within a comparatively short time. Although this would indicate that life cannot continue without the functioning of these glands, it is possible that it is only our lack of knowledge and our inability to perfect mechanical devices which would sustain life in the complete absence of these or any other of the ductless glands. It seems probable that the fundamental reactions involved occur entirely in the absence of the active agents of these glands and that they are incorporated in the animal organism to meet emergencies and to give the body a greater range of fluctuations in the production of energy. This is most striking in the myxœdema patient, living at a rate approximately 40 per cent below normal. In this condition the fundamental reactions involved are carried out probably in every detail the same except in the matter of rate. The administration of pure cyrstalline thyroxin permits such a body to increase the rate of the production of energy, and almost miraculously a long train of clinical symptoms is relieved.

In the study of the ductless glands the clinician is guided by the end-results of physiological processes. He is compelled to study these processes indirectly. However, these physiological processes are carried on by definite chemical substances, and when the chemist deals with these compounds he is working in an exact science. The slightest deviation from the necessary chemical structure destroys the value of the substance. It is a case in which "something just as good" will not do. In the co-operation between the chemist and the clinician what will be the greatest aid to the clinician is the isolation of each of the active constituents of all the ductless glands with the determination of their exact chemical influence on the animal organism.

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# THE THYROID AND ITS DISEASES[1]

BY CHARLES H. MAYO, M.D., F.A.C.S., ROCHESTER, MINNESOTA

A GENERAL familiarity with the thyroid, its structure, function, and derangements of secretion, with its varying pathology, is steadily growing, and each report on its various phases helps to maintain our interest and add to our knowledge. We know somewhat more of this gland than of any other in the body because of its conspicuous position, which makes noticeable simple enlargements or irregularities. The work of Kendall, representing years of intensive study, has resulted in explaining the chemical nature of the secretion of the gland. His results will, I believe, mark an epoch in medicine. In its possibilities of application to other organs, his work is as yet hardly appreciated by the medical profession, for not only has the active constituent been isolated and its chemical structure identified, but it has been made synthetically, thus giving a new enthusiasm to biochemic research.

The studies published by Magnus-Levy in 1895 on the influence of the thyroid in metabolism were a great advance in medicine and have been supported by others. The present standardizing of the effect of the thyroid secretion on metabolism is largely due to the work of Plummer, aided by Boothby and Sandiford, but made possible by Kendall's work. Boothby's and Sandiford's reports are based on about 18,000 metabolic tests, more than half of which were on patients with thyroid disorders. They not only confirmed that a hypofunction of the thyroid lowers the basal metabolic rate and a hyperfunction raises it, but also, by using Kendall's pure crystalline thyroxin, they have been able definitely to ascertain the amount of thyroxin in the body, the amount normally in the gland, the amount necessary to bring a definite hypothyroidism to normal, and the amount used up each day by the body. This work represents an epitome of the evolution of modern medicine.

The progress in medicine in the last few decades apparently has been due to the study of physiological chemistry in health and in disease. The activity and reproduction of single-celled organisms in suitable environment are apparently controlled by vital cell granules, possibly shown in mitochondria. In multicellular structures chemical activity is controlled by groups of special glands, one of which, the thyroid, if not the most essential to life, is one of the most essential to make life worth living, proved by the results of the mental and physical deficiency of the cretin at birth and by the myxœdematous patient in later life. It is protected for permanency as well as activity by its circulation, which is greater than that of any other gland.

The thyroid secretion makes available the energy of the cells of the body. This gland enables an individual to develop an available active, iodinized secretion from the iodides in food. At times some difficulty arises in the ability of the gland to function; thus simple goiter may be developed. From this standpoint two hypotheses might be considered; first, there is an unusual demand, and second, there is an inability of the gland to function, resulting in a hypertrophy with a failure in

[1]Presented before the Clinical Congress of the American College of Surgeons, Montreal, October, 1920.

some areas of the structure to deliver secretion. Iodine, found by Baumann in 1895 to be a constituent of the normal thyroid, is notably deficient in the gland of exophthalmic goiter and is variable in the gland of adenoma with hyperthyroidism. Moebius, in 1887, suggested a hyperfunction of the gland in exophthalmic goiter. Greenfield, in 1893, observed in six cases that diffuse parenchymatous hypertrophy and hyperplasia were present, and that the gland contained little colloid. Wilson, in 1908, confirmed and elaborated Moebius' theory and Greenfield's statement by a report on the first large series studied (294 cases) and showed that the amounts of hypertrophy and hyperplasia are usually in proportion to the severity of the symptoms.

Goiter appears in practically all countries, and is still believed by some authors to be due to a deficiency of iodine in certain geographic areas. This is hardly a satisfactory explanation for the small proportion of persons affected and the higher percentage of females. Some other and simpler cause at present elusive undoubtedly exists. The reason may lie in the chemistry of infection, toxæmia produced within the gland or at a distant focus, a chemical stimulant, bacterial or other, a problem which has been investigated by McCarrison and attributed to intestinal infection; this may be answered as our knowledge of colloid chemistry develops.

We know that the thyroid is stimulated by the physiological change of menstruation and of pregnancy, and that it is reduced by starvation and increased by overfeeding.

Plummer has shown that there is a variation in the ability of the intestine to absorb iodine. Some patients with myxœdema can be benefited only by the hypodermic administration of thyroxin.

Plummer and his co-workers have not only investigated the thyroid secretion and its relation to basal metabolism, but also presented to the medical profession a basic study of adenoma with hyperthyroidism. Since 1909 Plummer has shown conclusively that the condition resembling exophthalmic goiter and designated in Europe "pseudo Graves' disease," "Basedowized goiter," *formes frustes*, and other terms, but recognized as not the true disease, is hyperthyroidism due to adenoma. Such conditions have not been classified as they should be by American surgeons, falling below the standards of European reports on this subject. Hyperthyroidism occurs in certain goiters of long standing, 14 to 20 years, and is not accompanied by exophthalmos. The iodine content is variable. Mitochondria, shown by the presence of certain granules staining in the cell, may represent activity, possibly of growth, possibly of function. In the thyroid they were first shown by Bensley in the glands the opossum. Goetsch may have a valuable suggestion in showing their presence in adenoma with hyperthyroidism. As a rule, patients have tachycardia in irregular periods and develop irregularity in rhythm and tension. The average age of patients on the appearance of hyperthyroidism is 43 and their average age at operation is 48. In exophthalmic goiter the average age is about 36, and the exophthalmos occurs in 50 per cent within a few months, and in nearly 90 per cent within 2 years; there is tachycardia, but a steady pulse until degeneration occurs late in the disease.

The diagnosis of exophthalmic goiter, as a rule, can be made on signs and symptoms long since recognized as definite. The lymphocyte changes in the blood noted by Kocher have not proved trustworthy. The epinephrin injections recommended by Goetsch, while of value, may produce dangerous reactions or no reactions in well marked cases and may lead to wrong classification in possibly 20 per cent; many psychoneurotics will be placed with the group of patients with exophthalmic goiter. A failure of diagnosis is almost impossible if the basal metabolic rate is taken into consideration with other general symptoms. We have seen a few patients between the ages of 5 and 10 with all the symptoms of marked exophthalmic goiter, and a few between 50 and 60; the average age of patients, however, as they appear for operation is between 31 and 36.

It is not permissible in surgery of the thyroid to classify as adenoma with hyperthyroidism a large percentage of simple goiters which may be operated on with great

safety, much as it might improve mortality rates. Adenomata with hyperthyroidism should average but from 17 to 20 per cent of all cases of goiters with hyperthyroidism. Nor should the two types of hyperthyroidism with increased metabolic rates, tachycardia, and tremor, be confused.

Structurally the thyroid consists of a mass of encapsulated alveoli held together by a stroma of connective tissue, the vesicles lined by a single layer of cells which normally hold some colloid and may accumulate more. So far as we know the secretion in the interior of the vesicle can escape only by passing back through the cells that produced it (Bensley). In exophthalmic goiter there is a crowding of the epithelium and of the vesicles and no retention of secretion. In simple goiter and in the goiter of adolescence, an excess of light-colored secretion from œdema is retained. Later in life a denser deposit of colloid is noted and an encapsulated adenoma often develops on fœtal tissue, or a solid adenoma with colloid or degrees of calcareous and fibrous change, or of cystic degeneration which rarely is toxic. Plummer's suggestion that all the cells of the thyroid are not fully developed or mature at birth, and that later some are stimulated to activity or to hyperplasia, may be a factor in the chain of etiology.

That a goiter probably never wholly destroys the function of the gland has been demonstrated in observations of more than 100 cases of myxœdema and hypothyroidism; two-thirds of the patients had never had a goiter, but the gland had been destroyed by thyroiditis; in others the metabolic rate had been lowered by inactivity of the gland or surgical excess. It is true that simple goiters may occasionally cause low basal metabolic rates, from −8 to −12 per cent. It also has been shown that the basal metabolic rate must be −15 per cent before œdema occurs. The statements often made that removal of the thyroid tissue can be extensive or complete without producing myxœdema or symptoms are not supported by the metabolic rate tests of patients following radical or nearly complete extirpations of the glands.

Hypothyroidism is a better term than myxœdema in describing the true condition. Patients with cretinism are remarkably benefited and patients with myxœdema are cured by the administration of thyroxin. In the adolescent period the treatment of simple goiters that do not disappear of themselves, is iodine, thyroid secretion, or thyroid products. Iodine is slow in affording relief after goiter has developed, but Marine's work among the school girls of Akron, Ohio, shows it to be a prophylactic most useful in the prevention of goiter.

By giving thyroxin in goiter the gland seemingly is relieved of the burden or effort to functionate and is rapidly reduced by supplying the secretion. Operation is advised at any age in cases of round encapsulated adenomata causing distress. Partial removal of both lobes, with removal of the isthmus, is performed for goiter of long standing or goiter resisting treatment. In the preliminary medical treatment of such goiters in patients more than 40, care must be observed in giving iodine, since a degenerative process may be induced by its administration and toxic symptoms develop, a danger appreciated by Kocher. Cancer of the thyroid is rare. The rapidly-growing hard gland, if smooth and even, is probably due to a hæmorrhage in the gland structure. An irregular, hard, and nodular gland is probably malignant, especially if the adjacent lymphatics are enlarged. A hard, symmetrical, small gland that is not exophthalmic may possibly be tuberculous.

### THE DANGERS OF OPERATION

In cases of simple goiter the operative risk is from accidents or complications incident to delaying operation past the safe period. Operations in the early stages of exophthalmic goiter should be as safe as those in simple goiter, and here again we divide the work on both sides, using the Mikulicz method rather than the lobectomy of Kocher. After due consideration I may say that a few patients with exophthalmic goiter make good recoveries without operation; others make partial recoveries according to the degree of degeneration or secondary complications. Patients with exophthalmic goiter pass through exacerbations and remissions of symptoms; those in exacerbations are largely

influenced by psychic stimuli and are easily exhausted, in which case they should be medical and surgical patients, and if necessary treated by ligation, rays, hot water injections (17), and absolute rest in order to tide them through the dangerous period. It is a lack of appreciation of surgical responsibility to say that elaborate preparation in serious cases, the use of local and combined anæsthesias, hypnotic, narcotic, or local and general, is unnecessary or useless when the mortality is so low following these methods. Even if the preparation is unnecessary in some cases, it is justified by the general results and will do much to encourage careful examinations, painstaking care, gentleness, and attention to detail in the operation. Experience with success or failure only enables the individual operator to justify methods.

A patient with a metabolic rate of about +66, who has survived a recent exacerbation and is improving, is a safer surgical risk than a patient with a metabolic rate of +46, who is on the rising wave of an exacerbation. With X-ray treatment, remission may occur just as remissions occur without treatment or with several other methods of treatment. Our experience has been failure or but temporary benefit. It is possible that the ray treatment may destroy the gland and produce hypothyroidism. It is difficult to regulate the dosage, and its use adds to the difficulties of operation. It is to be hoped that radiotherapy may be developed into a safe and effective method of securing a cure or relief in preparation for surgery.

In the operative treatment of all patients having difficulty of respiration, usually patients with large goiters and scabbard tracheas, a primary central division should be made of the isthmus with a turning outward of the lobes from the trachea in their resection, as recommended by Balfour. Nerve injury seldom occurs except by crushing with forceps, which can be avoided by the preservation of the posterior capsule and such gland material connected with it posteriorly as it has been decided should be saved; in this manner the parathyroids are also protected.

In the Clinic during 1919, 1,707 of 2,205 operations on the thyroid were performed with ether anæsthesia, 135 with novocaine, and 363 by combined methods. The mortality rate has been greatly reduced during the last 20 years. The old vicious circle of late operation and high mortality and the high mortality conducing to a late operation has been largely overcome. More and more patients with hyperthyroidism are seen early, and the natural risks are thereby greatly reduced. Now only about 20 per cent of these patients come in the late stages. The consequent reduction in mortality is not wholly due to the surgeon's increased ability and technique, but partially to the general advance of professional knowledge and to the diagnostician's co-operation. We were greatly pleased in an early series to perform 46 consecutive operations for exophthalmic goiter between deaths; in a later series 72, and still later 144 between deaths. According to the condition of the patients and best judgment in their treatment, the mortality will vary from 0 to 3 or even 4 per cent in various groups of 100.

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# THE PROTECTION OF THE PATIENT IN SURGERY OF THE THYROID

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MY part in a program, the other participants in which are the outstanding figures of the greatest goiter clinic in the history of surgery, is a discussion of the protection of the patient in surgery of the thyroid—of the exophthalmic goiter patient in particular. Against what is the exophthalmic goiter patient to be protected? He should be protected against the fatally excessive metabolism which the operation tends to induce, against failure of the already weakened myocardium, and against acidosis.

These factors may be regarded as end-effects of impairment or failure of the internal respiration of the organism. The total activity of the cell of the liver, of the brain, of the myocardium may be regarded as its internal respiration. What does the cell require to assure the maintenance of its normal, orderly, internal respiration? The cell requires a normal supply of oxygen; a normal supply of fresh water; a normal supply of food—mostly in the form of glucose.

What is the probable state of the cells of the myocardium, of the brain, and of the liver in cases of advanced exophthalmic goiter? The permeability of the membranes of the cells is probably greatly increased as is indicated by the effect of iodism on their electric conductivity. That is to say, the cells of the organs are excessively sensitive, and therefore the patient must be protected against the psychic stimuli of fear and worry before, during, and after the operation. This is accomplished by establishing confidence, by preventing knowledge of the time of the operation, by the exclusion of anæsthetics that produce a stage of excitation.

The abnormal sensitization of the cells in exophthalmic goiter cases necessitates the protection of local anæsthesia, even if surgical anæsthesia is employed also.

These sensitized patients require protection against any infection stimuli; and, in extreme cases, they must be guarded against even the absorption of aseptic wound secretion or of hæmoglobin.

In brief, these patients must be guarded against psychic, traumatic, biochemical, and anæsthetic stimuli; and, in addition, against the effects of the secretion of the thyroid itself. Whether the operation is to be performed with the patient in bed or in the operating room, on the day of operation he should see no surgeon, should see no preparation, should see no operating room, but should see only the already familiar anæsthetist, the already familiar anæsthetic apparatus; should experience only the already familiar odor of the gas and oxygen, and the already familiar sensation of this type of anæsthesia. The end to be achieved is the maintenance of an unbroken state of negativity, while the exquisitely sensitized organism is carried through the processes of the ligation of an artery, and of

[1]Presented before the Clinical Congress of American College of Surgeons, Montreal, October, 1920.

the removal of a part of one or both lobes of the thyroid.

In the absence of other damaging influences, to be discussed presently, the internal respiration, and hence the function of the myocardium, of the cells of the nervous system, and of the cells of the liver are not disturbed by the operation; the appearance of the clinical chart is not disturbed; the patient is safe.

Protection against excitation and against excessive activity is not the only protection required by the exophthalmic goiter patient. Protection against suboxidation is required also. The internal respiration, hence the life of the patient, is immediately dependent upon a continuous supply of oxygen; hence asphyxia, or deep inhalation anæsthesia, quickly suppresses the internal respiration, and causes death, either immediately or within a few hours or a day or more. The clinical course in such a case is similar to that produced by fear, worry, physical injury, exertion, or infection. Since all inhalation anæsthetics cause suboxidation in extreme cases, deep surgical anæsthesia, especially ether anæsthesia, is ruled out. Gas and oxygen analgesia, combined with local anæsthesia, is entirely free from this serious objection. Ether anæsthesia almost wholly suspends the internal respiration and is especially damaging.

As regards the adaptation of the degree of anæsthesia to the individual patient, the judgment of a highly experienced anæsthetist is priceless. In this respect, the judgment of Miss Hodgins, chief anæsthetist of the Lakeside Clinic, is almost unfailing.

A weak myocardium or a decompensated heart leads to serious suboxidation because of the diminished blood supply. Against this condition the patient is best protected by one or two courses of digitalis, each consisting of 30 minims of the tincture of digitalis every four hours for fifteen doses, repeated as may be required until œdema disappears and the tone of the heart is as good as its condition will permit.

A much neglected requirement for the maintenance of the normal, internal respiration is water. Advanced cases of exophthalmic goiter commonly have cycles of vomiting. These may be controlled by sufficient water, for water seems to bear some relation to the cause of vomiting, which rarely occurs if a good water equilibrium is maintained. It is probable that the clinician fails to appreciate the great loss of water through the skin, and that the raging metabolism of the exophthalmic goiter case requires much more water than a normal individual; just as an engine running under full pressure at 60 miles an hour requires more water than an engine running only 25 miles an hour. The goiter case, like the express engine, must be protected against burning out his "boiler" by urging water by the mouth; or if enough cannot be introduced by this normal route, then under the protection of local anæsthesia, from 3000 to 4000 cubic centimeters may be given subcutaneously every 24 hours until the crisis is past.

There is evidence, although it is not conclusive, that the patient should be protected against the too sudden withdrawal of thyroid activity. This danger may be eliminated by the administration of thyroid extract before the operation. By giving 2 grains the evening before, and 2 grains on the morning of the operation, the dose will become effective at the time the thyroidectomy is performed. If, later, the patient seems apathetic, it is well to continue the administration of the thyroid extract for some days. The necessity for providing a more or less gradual decline rather than a sudden decrease in the amount of the thyroid hormone is supported also by the fact that the safest operation is a graded operation: first a ligation of one superior thyroid artery; then, of a second; and finally, after an interval, the length of which is determined by the needs of the individual patient, a unilateral or a bilateral partial thyroidectomy. In a serious situation, even if we could "wish out" the thyroid, the sudden break might be fatal.

In great hazards in which, after the preliminary ligations, a period of physiological rest has brought insufficient improvement, the thyroidectomy is performed with the patient in bed under analgesia and local anæsthesia in order that the already impaired internal respiration may be protected to the utmost from too prolonged general anæsthesia

or from the slight disturbance which attends transit to the operating room, even when the transit is made with the patient under anæsthesia.

If the hazard still is great, and the pulse runs up during the operation, the wound is left open to protect the patient from the absorption of wound secretions and from postoperative pain and also to shorten a hazardous operation by a few but possibly decisive minutes. Following ligation protection against postoperative pain is secured by quinine and urea hydrochlorid. The open wound is protected by flavine gauze dressings, or by sterile dressings which protect the wound almost as well, until its closure under analgesia on the afternoon of the same day or on the following morning. This affords a graded surgical contact.

Finally, and of the greatest importance, the patient must be protected against the so-called postoperative hyperthyroidism. If the pulse and the temperature begin to rise, and restlessness is marked, ice-bags are applied in approximately the following manner: if the temperature reaches 101°, four ice bags are applied to the thorax and the extremities; at 102°, from 8 to 12 ice-bags are applied to the thorax, the abdomen, and the extremities. If the temperature rises to 103° or over, the temperature is reduced by refrigeration, which is accomplished by placing the patient in an ice-pack in the following manner: rubber sheets are placed over and under the patient, who is then entirely covered with from 150 to 200 pounds of cracked ice. An electric fan is mounted at the foot of the bed, the air current being directed toward the patient's face. In case of great urgency, salt may be added. The reduction of the temperature is certain, and as a rule, under this treatment the fall in temperature averages two degrees per hour. The temperature is closely watched while the patient is in the ice-pack, which is discontinued when the temperature has fallen to 100°.

SUMMARY

The "bad risk" patient should be protected—
Against suboxidation,
Against inhalation anæsthesia,
Against want of water,
Against pain,
Against absorption of wound secretions,
Against infection,
Against fear and worry,
Against postoperative hyperthyroidism,
Against postoperative hypothyroidism.

When protection against these is assured the operability of the "bad risk" goiter patient becomes 100 per cent; and the mortality is reduced to that attending the removal of benign pelvic tumors.

The formulation of this plan of treatment has been based upon experimental researches and upon the clinical study of a personal series of 821 ligations and of 2,771 thyroidectomies. Of the latter, 1,315 have been for exophthalmic goiter.

By the application of these measures, the mortality rate of all thyroidectomies has been reduced to 1.3 per cent; of thyroidectomies for exophthalmic goiter, to 1.8 per cent; of ligations, to 0.6 per cent.

Our final series, still unbroken, includes 322 thyroidectomies and 139 ligations without a death.

# TUMORS OF THE KIDNEY[1]

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DURING the past 7 years, we have had the opportunity to observe 40 cases of renal tumor which came to operation. The pathology of the growths was, in most instances, proven microscopically. Thirty-eight of the tumors were malignant; two, benign in character, were confined to the renal pelvis and did not involve the parenchyma.

The 40 cases may be classified as follows:

| | |
|---|---|
| Hypernephroma | 28 |
| Mixed tumors (Wilms) | 8 |
| Adenocarcinoma | 2 |
| Papilloma of renal pelvis | 1 |
| Angioma of renal pelvis | 1 |

Because of certain points of clinical and pathological differentiation, it is considered advisable to discuss each group separately.

## HYPERNEPHROMA

The high percentage of hypernephroma in our series coincides with the statistics of numerous authors, who have found these growths to be the predominating type of kidney tumor. The following relative frequency of renal tumors, in general, has been reported:

| | Kidney Tumors | Hypernephromata | All Other Types |
|---|---|---|---|
| Israel | 126 | 86 | 40 |
| Albrecht | 32 | 28 | 4 |
| Barney | 114 | 43 | 71 |
| Boston City and Massachusetts General Hospital | 42 | 33 | 9 |
| Mayo Clinic (1911) | 56 | 36 | 20 |
| Mt. Sinai Hosp. (A. A. Berg) | 38 | 36 | 2 |
| Pleschner | 35 | 25 | 10 |

Hypernephromata are most frequently encountered in the fourth and fifth decades. The age incidence, in our series, was as follows:

| Age | Number of Cases |
|---|---|
| 1 to 10 years | 1 |
| 10 to 20 years | 0 |
| 20 to 30 years | 1 |
| 30 to 40 years | 3 |
| 40 to 50 years | 11 |
| 50 to 60 years | 10 |
| 60 to 70 years | 2 |

Most authors state that males are more often afflicted than females. In our group, there were 8 females and 20 males, an unusually high percentage for the latter sex.

The right kidney was diseased seventeen times, the left eleven. Larger series of cases show but slight differences in the side affected. Only occasionally there was a history of heredity; twice it was stated positively that the tumor was noted soon after trauma.

Calculi were found in two of the hypernephromatous kidneys; this finding is not uncommon. In one case, considerable pus was obtained on catheterizing the affected kidney; this with a positive stone shadow, led to a diagnosis of calculous pyonephrosis. Operation revealed a pyonephrotic kidney with a small hypernephroma at the upper pole. The symptoms were caused by the stone and pus kidney, and not by the tumor. Albarran and Imbert (1) collected 26 cases of renal tumor in which stones were present; Coryell (2), reporting 140 kidney tumors from the Mayo Clinic, found calculi associated nine times. One of our cases was complicated by lues and an attack of acute appendicitis which developed prior to operation. An inflamed appendix was ablated through the transperitoneal incision employed for removing the growth. In another instance, a 4 months' pregnancy was associated with the hypernephroma. A transperitoneal nephrectomy was performed, the patient went on to full term and had a normal labor.

*Pathogenesis.* Since this report deals chiefly with the clinical manifestations of hypernephroma, it is not our intention to enter upon a detailed account of the theories concerning their origin. Suffice it to say, that at present there is still considerable discussion among pathologists and clinicians. The term hypernephroma was first applied by Birch-Hirschfeld (3) to tumors having their origin in adrenal tissue (adrenal rests), located outside the suprarenal gland. These aberrant rests are

[1] Presented before the American Urological Association, March 25, 1920. From the Surgical Service of Dr. Beer, Mt. Sinai Hospital.

most commonly found beneath the kidney capsule, but have also been seen in the liver, in the peritoneum, and in the region of the ovaries. Coeneus (4) has reported a primary hypernephroma of the tongue, without renal or adrenal involvement, and Roedler-Zipkin (5), a hypernephroma of the adrenal without renal invasion. Grawitz's (6) explanation, that hypernephromata are due to aberrant "adrenal rests" was the one most widely accepted for many years until Stoerck (7) and others pointed out certain discrepancies, and claimed that they were renal in origin. At the present, Stoerck's views are most commonly accepted. Wilson (8) has lately advanced the theory that hypernephromata are not adrenal in origin, but are "included islands of nephrogenic tissue," originating from the remains of the wolffian bodies, and suggests calling them mesothelioma.

*Pathological anatomy.* Hypernephromata vary considerably in size and location, and may be found in any part of the kidney. It was stated at one time that most of them were situated in the upper pole. This, however, has been disproved, and more often the tumor is found near the center of the kidney or at the lower pole.

A peculiar characteristic of these growths is their tendency to break into the renal vein, which at operation or postmortem is found occluded by masses of tumor tissue. Cases have been reported in which the vena cava has been so involved, and in which the thrombosis extended to the heart. In one instance, in this series, the hypernephromatous thrombus extended over to the opposite renal vein. In eight others, the renal vein on the affected side was found infiltrated at the time of operation. Bloch (9) found extension into the renal vein, in 13 of 86 cases. Of interest is the fact that such a thrombus may be present in the vena cava without producing œdema of the lower extremities. Hypernephroma metastases are not infrequently solitary. Cases are reported in which a single secondary growth has developed years after nephrectomy; a few have been successfully removed. Occasionally, the first evidence of the disease has been the appearance of one or more metastases in the bone, without any clinical manifestations of malignancy on the part of the kidney. Since the metastatic growths present the same pathological structure as the primary hypernephroma, the diagnosis of such a condition is not difficult. There are also points of differentiation by which these metastatic bone tumors can be recognized roentgenographically. A short time ago, we observed a young man, who on physical examination disclosed a prominent tumor in the region of the liver. There were no symptoms referable to the kidney, not even microscopic blood. At operation the liver was found studded with hypernephromata. In such cases the question arises whether we are dealing with a metastatic tumor of renal origin, or one of the rare cases of liver hypernephroma. When last seen, a few months after operation, there were no symptoms or clinical manifestations of renal involvement. The metastases are most frequently located in the long bones, the bones of the skull, and in the lungs and the liver; the brain and spinal cord are not infrequently involved. Dissemination by way of the lymphatics is unusual, but occasionally the retroperitoneal glands have been found involved. The secondary growths may occur very late in the course of the disease; numerous instances being reported of metastases developing 4 to 5 years after the appearance of the primary tumor or after nephrectomy. Clairmont (10) has reported a case in which the metastasis appeared 10 years after the kidney was removed; Albrecht (11), a similar one with a secondary growth developing seven years after nephrectomy.

*Symptomatology and clinical signs.* The most frequent initial symptom is hæmaturia, then pain, and finally tumor formation. Unfortunately, the presence of this combination of symptoms generally signifies a condition far advanced. From a careful study of the 28 cases in our series, it is evident that hypernephroma is seldom diagnosed in an early stage. This is due to a number of factors; some of them within the control of the physician. A short time ago an excellent pamphlet on cancer was distributed by the U. S. Health Service to the lay public. It laid emphasis on the evil consequences of delay in cancerous conditions of the various

organs, and urged the necessity of early recognition and immediate attention to symptoms of breast, uterine, tongue, and other carcinomata. No mention, however, was made of a very frequent urological symptom: hæmaturia. If we are to make an early diagnosis of malignancy of the urinary organs, it will only come about through a campaign of education; impressing upon the laity the necessity and importance of a careful examination upon the first appearance of blood in the urine. It is, alas, only too true, that often the initial hæmaturia denotes a far advanced hypernephroma; in numerous instances, however, it is but a warning of impending danger. The importance of hæmaturia in this disease is made evident by noting that in from 50 to 70 per cent of the cases recorded in the literature, it was the primary symptom, and was present, in even a larger number, during the subsequent course of the disease.

The following tabulation of our cases, showing the duration of one or more of the cardinal symptoms of hypernephroma (hæmaturia, pain, tumor), prior to operation, may be of interest:

| | Cases |
|---|---|
| 1 year | 6 |
| 2 years | 4 |
| 3 years | 5 |
| 4 years | 1 |
| 8 months | 2 |
| 7 months | 1 |
| 6 months | 3 |
| 1 to 5 months | 6 |
| Total | 28 |

As previously mentioned, it has been observed that not very infrequently the disease has already made such rapid progress upon the first appearance of hæmaturia, as to preclude the possibility of a cure. Thus in Case 3, in which the initial hæmaturia was observed 8 weeks previously, the growth had already invaded the renal vein, and a pulmonary metastasis was present.

It is unfortunate that the hæmaturia is so often transient and intermittent in character. In looking over our records, one is struck by the fact that frequently the first attack of hæmaturia was observed years (1 to 3) prior to examination. The cessation of bleeding without medical treatment, followed by a long intermission before the appearance of the next hæmaturia, served to lull these patients into a false sense of security. In 28 cases, bloody urine was found macroscopically 16 times; in 8, the blood was microscopic; only in 4 cases was it absent. In numerous instances, typical ureteral blood casts were passed, several times, unaccompanied by the usual colic-like pains. The bleeding is occasionally most profuse, instances being recorded where one hæmorrhage proved almost fatal. According to Danaclara (12), the hæmaturia associated with hypernephroma is not a prolonged one, as in bladder tumor or other conditions; in but one case of a series of 146, did the attack last as long as 2 weeks.

Pain is a variable symptom and two types must be differentiated: that due to the passage of clots with consequent distention of the pelvis, and a spontaneous pain, independent of any bleeding. Pain often precedes other symptoms or signs of a tumor, by many years, and may be the only symptom present. The pain is of three varieties, either dull, neuralgic, or colic-like in nature, the radiation being generally along the distribution of the ilioinguinal and genitocrural nerves. Pain as an initial symptom is present in from 30 to 40 per cent of the cases. In our series, at least 40 per cent of the patients complained of lumbar pain some time or other during the course of the disease; in a few, this symptom preceded macroscopic hæmaturia by 2 to 5 years.

Tumor is present in 60 to 80 per cent of cases that come to operation. Undoubtedly small growths, especially when situated in the upper pole of the kidney and hidden behind the ribs, are frequently overlooked. It is of significance that in 28 cases a palpable tumor was present in 24. The percentage of positive findings will depend a great deal upon the individual skill in such manipulations. Israel (13) reports palpating a hypernephroma, the size of a walnut. Examination in the lateral position may aid considerably in outlining a tumor. The tumors vary considerably in size, shape, and relation to the surrounding tissues. The small growths are generally hard and nodular, the large ones vary in consistency, from extreme hardness to semi-fluctuation, and are very often firmly fixed in their posi-

tions. These firmly adherent tumors generally proved to be inoperable. Attention may here be called to the dangers of rough palpation; hæmorrhage may be produced, and the possibility of pressing out tumor fragments into the general circulation must be considered. Inflation of the colon may aid in confirming the retroperitoneal position of the growth, small tumors as a rule lying posterior to the colon, larger ones displacing the colon inward.

In summarizing the three cardinal symptoms of renal tumor as presented in our series, we find hæmaturia the most frequent initial symptom, and present in over 90 per cent of cases, some time during the course of the disease. Pain as an initial symptom was noted in 30 per cent, and was present in more than 40 per cent at one time or another. A tumor was palpated in 85 per cent of the cases. A number of patients complained of all three symptoms, and in more than 85 per cent two of the classical symptoms were present. This résumé will serve to indicate the difficulty of making an early diagnosis of hypernephroma.

Symptomatic varicocele painless, and rapid in formation, on the side of the growth was first noted by Guyon. It generally disappears after operation, and differs from idiopathic varicocele in that it does not disappear on lying down; and its first appearance is observed in middle or advanced years. In none of our cases were we able to demonstrate this phenomenon. A few patients complained of loss of weight, weakness and gastro-intestinal disturbances. Cachexia is usually a late manifestation, patients often noting symptoms for years before the general health becomes affected. Fever, between 100° and 102° was observed in a few instances, without the presence of pus in the urine; its significance is not clear; Israel (14) reports its presence in 57 per cent of his cases.

All the symptoms enumerated above may be considered under the caption of clinical manifestations. Of equal importance and practically indispensable are the data obtained by special urological examinations. Pain and hæmaturia may be due to any number of urinary conditions which can only be differentiated by a proper use of the cystoscope and X-ray.

*Urological diagnosis.* The importance of a careful urinalysis cannot be too strongly emphasized, especially on account of the frequency of microrcopic blood. Tumor cells are rarely found in the urine. Radiography by outlining the size and shape of the kidney, will often prove of value. In a number of cases, we have been able to exclude a tumor by a roentgenogram, showing a perfectly normal kidney shadow. Enlargements and irregularities of renal outline are readily seen. The association of stone with tumor should not be overlooked, and due allowance made for this occurrence. Skiagraphy should also be employed for determining the presence of metastasis in the bones or pulmonary system, prior to operation.

*Renal function.* Our mode of procedure is as follows: A phenolsulphonepthalein estimation of a two to three hour bladder specimen to ascertain the functional capacity of both kidneys, is followed by a determination of urea, uric acid, and creatinin in the blood. A complete cystoscopic examination, including ureteral catheterization is then performed, in conjunction with indigocarmine as a test of individual kidney function. To exclude hydronephrosis, calculus, and other conditions, additional tests combined with cystoscopy may be deemed advisable. Briefly mentioned, these are the distention test, to determine the nature and location of pain, and to ascertain the capacity of the renal pelvis; and the passage of wax tipped bougies to exclude calculus. A study of the indigocarmine excretion in our series of hypernephromata showed that in many cases the function of the diseased kidney was considerably diminished, and in numerous instances entirely absent. Functional tests, whereas of value in determining the degree of renal impairment, are not of particular diagnostic importance when judged alone, because similar findings are encountered in so many other conditions. Studied carefully in conjunction with the history and physical examination, their significance increases. Blood clots were often seen protruding from the ureteral orifice on the side of the diseased kidney. Forcible manipulation of

the ureteral catheter in the renal pelvis with the idea of traumatizing the growth and producing bleeding, as recently described by Beer, will prove of value occasionally. In two cases with clear urine, and absence of tumor and lumbar pain, it was only possible to determine the affected kidney by producing a hæmaturia on the diseased side by this procedure. Pyelography, by revealing certain characteristic deformities in the renal pelvis and calyces, will occasionally prove of considerable aid in the diagnosis. Braasch (16) found distortions in pelvic outline seventeen times in 22 cases. In our series, pyelography was only occasionally employed; in two instances, data so obtained aided in establishing the diagnosis.

*Diagnosis and differential diagnosis.* As previously stated the disease is seldom diagnosed in an early stage. In the cases presenting the cardinal symptoms (hæmaturia, pain, tumor) the diagnosis is almost self-evident. The difficulty arises in differentiating the initial symptoms, pain and hæmaturia. Persistent lumbar pain, with or without hæmaturia in a middle aged individual should arouse suspicions of malignancy, and render necessary the examinations previously mentioned. Calculus, tuberculosis, and pyogenic infections can usually be excluded as etiological factors; the absence of these conditions would tend to strengthen the suspicion of renal tumor. Pyelography may be of valuable assistance in such an early case. When in doubt, an exploratory incision is indicated.

It is not always possible to differentiate between hypernephroma and other malignant kidney tumors. As previously mentioned, hypernephroma is the most frequent type of renal tumor, the course of the disease is often slow in progress, the symptoms extending over a period of years, cachexia is a late manifestation, and single metastases are not uncommon. Hæmaturia is not as pronounced as in carcinoma and the intervals between attacks of bleeding are often years apart. In carcinoma, cachexia appears early, the course is rapid, and metastases are multiple.

*Treatment.* There is only one recognized form of treatment, and that is early nephrectomy. Radium and deep X-ray therapy have not as yet usurped the place of the scalpel in this condition. They are to be employed after operation and may be of value in preventing local recurrences. Resection of malignant kidney tumors, no matter how small the growth, is not to be considered.

The question arises as to the advisability of nephrectomy in the presence of a metastatic deposit. Radical surgery, of course, is not to be considered if multiple growths are found disseminated. Under certain circumstances (uncontrollable renal hæmorrhage), as a life saving measure, it may become necessary to remove the kidney, even though an inoperable secondary deposit is present. A single metastasis readily reached surgically, and in the absence of cachexia, should not contra-indicate radical operation. The kidney should first be extirpated, followed as soon as possible by the excision of the secondary growth. Albrecht (16) has reported a few instances in which patients lived for years following the removal of a secondary deposit. Of these, one case in particular is interesting; nephrectomy was performed 12½ years ago, 3 years after a metastatic bone tumor in the scapula was extirpated and the patient was still alive 9 years later. It is advisable before operating to radiograph all the bones and the lungs, to exclude metastases producing no symptoms. A large firmly fixed growth, which has broken through the capsule and invaded the surrounding tissues, should deter one from operating, as it will be impossible to do a nephrectomy in such a type case. Whenever in doubt, however, the patient should be given the benefit of an exploratory operation.

An important point, still a matter of discussion, concerns the method of approach (lumbar or transperitoneal). In small or moderate-sized growths, the lumbar route is advisable; with very large tumors the transperitoneal operation is preferable, as a better exposure is obtained, rendering it simpler to mobilize the kidney, especially when it is adherent. The latter incision permits of easier approach to the pedicle, and also has the added advantage of enabling one to determine the presence of secondary intra-abdominal deposits, which would render further procedures useless. It is desirable to ligate

the renal vein as early in the operation as possible to prevent neoplastic tissue from being squeezed into the general circulation by forcible manipulations in delivering the kidney. The renal vein should be ligated as close to the vena cava as possible, and attempts should be made to extract tumor thrombi that may be present. A transverse incision has also been recommended, dividing all the lumbar muscles transversely to the median line in front, and then opening the peritoneal cavity.

In our series of 28 operations for hypernephroma, there were 20 nephrectomies. The lumbar route was employed sixteen times; the transperitoneal, four. In eight cases operation revealed an inoperable growth, either on account of extension and adhesion to surrounding parts, or because of the presence of intra-abdominal metastases. Five of these explorations were transperitoneal operations. As previously mentioned, the renal vein was found thrombosed nine times. Specimens for microscopic examination were removed in all but two of the growths, which proved to be inoperable.

*Anæsthetic.* Gas and ether anæsthesia was generally employed, occasionally gas and oxygen. Two patients were explored under local, and one was nephrectomized under spinal, anæsthesia. In the latter instance the patient's general condition was very poor, the anæsthesia was perfect, and the kidney successfully removed.

*Operative mortality.* Statistics from various clinics reveal considerable differences in mortality figures. Albarran and Imbert report an operative mortality of 23 per cent for lumbar nephrectomy, and 21 per cent for the transperitoneal operation; Albrecht, 24 cases, 33.3 per cent mortality; Pleschner, 25 per cent; Israel, 18.6 per cent; Garceau, 30 per cent; Braasch, 11 per cent; Paschen, 11 per cent; Berlstein, 33.3 per cent. Pleschner (17), in reviewing the literature, reports the following mortality statistics for the various types of operation:

| Types of Operation | Per Cent |
|---|---|
| Transperitoneal nephrectomy | 37.5 |
| Lumbar nephrectomy | 13.5 |
| Lumbar nephrectomy with opening of peritoneum | 33. |

Most of the deaths have been due to cardiac insufficiency, pneumonia, peritonitis, and uræmia. Cardiac failure has been mentioned as the cause of death in an unusually high percentage of cases (66.7 per cent Israel, 18). Israel attributes this to a toxic myocarditis, due to breaking down of hypernephroma tissue, and notes that cardiac failure is more frequently observed in cases in which the vena cava has been invaded by the growth. In the majority of cases there were no previous evidences of cardiac disease.

Of the 28 patients operated upon in this series, there were twenty nephrectomies with 1 death, a mortality of 5 per cent. This patient died with uræmia manifestations 10 days after operation; at postmortem, it was found that the growth extended from one renal vein into the vein of the opposite kidney. Among the 8 exploratory operations, 1 patient died 6 days after, from general weakness. This operation was performed under local anæsthesia, and an inoperable tumor found.

*Course of disease and remote results.* The disease is often very slow in progress up to a certain point, after which the virulence seems to increase, and the patients rapidly lose ground. It is not unusual for patients to present symptoms 2 to 5 years before seeking relief. The prognosis in general is bad, death occurring from recurrence or metastases, as late as 10 years after operation.

The majority of recurrences take place within the first 2 to 3 years following operation; and although reported, are very infrequent after 5 years. Clairmont describes a case in which death took place 10 years after operation, from a metastasis in the chest. and Albrecht's patient died from metastases 7 years after nephrectomy. The size of the growth apparently bears little relation to the prognosis. Small growths have been known to metastasize as quickly as larger ones. Involvement of the renal vein does not necessarily render the prognosis fatal, although it diminishes considerably the chance of a cure. Albrecht (19) reports 2 cases in which the veins were thrombosed with hypernephroma tissue at the time of operation; one patient was alive and well, 4 years after, the other patient was well when last observed 12 years after nephrec-

tomy. In 2 cases in our series, the renal vein was found partially occluded with hypernephroma tissue at the time of operation. Both patients are alive, without evidence of recurrence or metastasis, 4½ and 3½ years after operation. The chances for a cure are considerably diminished if the tumor has broken through the capsule of the kidney. The following table may prove of interest:

| | Postoperative Mortality Percentage | Recurrence Percentage | Cures (at least 3 years) Percentage |
|---|---|---|---|
| Albrecht | 33.3 | 56.2 | 37.5 |
| Pleschner (20) | 25. | 53.3 | 35. |
| Paschen (21) | 11.1 | 31.4 | 35.1 |
| Berlstein (22) | 33.3 | 66.6 | 22.2 |

The question arises, when can a patient who has had a hypernephroma be considered cured. This is not so easily answered, for although most of the recurrence takes place within a few years, it is characteristic of hypernephroma to metastasize very late. Besides cases previously mentioned by Clairmont and Albrecht, Fischer reports a metastasis appearing 6 years and 9 months after nephrectomy; Kroenlein, 6 and 11 years after, and numerous instances, 4 to 5 years after.

It is difficult to give estimates of cures in hypernephroma, with any degree of accuracy, but most statistics bear witness to the extreme malignancy of this condition. Albarran and Imbert are of the opinion that about 28 per cent are cured. In the 16 cases reported by Albrecht, 9 died from recurrence or metastasis, 6 were still alive; of these, but 2 had passed the 3-year period. Of Israel's 34 cases, 18 died of recurrences within 2 years' time. In Watson and Cunningham's report of 143 cases, 31 patients were found to be living; only 9 of these had passed the 3-year limit. In a series of 43 cases in which nephrectomy had been performed, Garceau (23) reported 39 as having died within 3 years; 33 of metastasis. Braasch (24) reports 27 per cent of 3-year cures and 10 per cent of 4-year cures, following nephrectomy, and Kuester (25), 11 per cent cures at the end of 4 years. Of 25 cases reported by Berg (26) in his first series, all had died within 7 years; of 13 cases in the second group, 6 were known to be dead at the time of publication of the article. Stoerck is of the opinion that the course of the disease can be explained by the pathological anatomy of hypernephroma and distinguishes two types of the disease, benign and malignant. In the first variety the tumor is sharply encapsulated from the surrounding kidney tissue. These growths may be present for years, without causing symptoms. In the second or malignant type, the tumor breaks through its capsule, and into the general circulation producing metastasis.

The result in our series may be tabulated as follows:

| | |
|---|---|
| Number of cases operated upon | 28 |
| Number of nephrectomies | 20 |
| Died following nephrectomy | 1 |
| Exploratory operations (all inoperable) | 8 |
| Died following exploratory operations | 1 |
| Deaths within first year from recurrence or metastases | 9 |
| Deaths in second year from recurrence or metastases. | 5 |
| Data not obtainable | 6 |
| Nephrectomized cases with complete postoperative data | 12 |
| Alive 6 months after nephrectomy | 1 |
| Alive 1 year after nephrectomy | 1 |
| Alive 3½ years after nephrectomy | 1 |
| Alive 4½ years after nephrectomy | 2 |
| Alive 7½ years after nephrectomy | 1 |
| Percentage of cures over 3½-year period | 33.3 |

It is of interest to note that 3 patients who have already survived nephrectomy 3½ years, had well advanced processes. The kidney in one was densely adherent, and the growth had perforated through its capsule into the renal pelvis. In the other 2 cases, the renal vein contained hypernephroma thrombi at the time of operation.

### MIXED TUMORS OF THE KIDNEY

Wilms tumors (27) are most frequently encountered in the first 3 years of life; occasional cases in the adult are observed. In a series of 165 mixed kidney tumors reported, 131 appeared within the first 6 years of age. These growths are supposed to take origin in embryonic tissue, and are composed of collections of epithelium, in the nature of tubular or glandular structures, containing besides smooth and striped muscle fibers, cartilage, fat, bone, and proliferating connective tissue of mesothelial origin. The latter tissue is the one most frequently found. The tumors originate in the substance of the kidney and grow directly into the parenchyma, but do not

infiltrate as the sarcomata or carcinomata generally do.

The sex and age incidence in our series was as follows:

| | Sex | Age Years |
|---|---|---|
| Case 1 | Male | 6 |
| Case 2 | Female | 2¾ |
| Case 3 | Male | 1½ |
| Case 4 | Female | 3 |
| Case 5 | Female | 3 |
| Case 6 | Female | 4 |
| Case 7 | Female | 22 |
| Case 8 | Male | 3 |

Trauma has been mentioned as a predisposing cause; such a history was obtained in one case. In Case 8, the disease was bilateral. Walker reports 10 such instances in 141 cases. Clinically, mixed tumors are characterized by their large size (at times filling almost the entire abdominal cavity), absence of pain in most instances, and apparent good health of the patient. Cachexia is a late manifestation. Often subjective symptoms are absent and the growth is not discovered until it has reached a very large size. Metastases are relatively infrequent. These growths are exceedingly malignant, and death is generally due to local recurrence and cachexia. Hæmaturia is not a prominent symptom, and when it does take place is usually not severe.

In the series under discussion, pain was present in 4 cases, hæmaturia in 3. The diseased kidney was markedly enlarged in all 8 cases. Gastro-intestinal symptoms were not uncommon, fever was occasionally present. The urine with the exception of red blood cells showed no changes. The dense shadow of the enlarged kidney was clearly shown in the roentgenograms. Three of the children in the group were cystoscoped prior to operation and showed absence of secretion and function from the diseased kidney.

*Treatment.* Nephrectomy as early as possible offers the only hope of a cure. The size of the growth should not contra-indicate its removal. The same general principles prevail as previously mentioned for nephrectomy in adults. The danger of shock and hæmorrhage are greater than is the case with adults, and speed is a desideratum. As to the method of approach, the transperitoneal is the route usually employed. Most of these growths are too large to permit of removal through a lumbar incision. The operative mortality statistics in 122 cases, collected by Albarran and Imbert, was 24 per cent. Walker, in 74 nephrectomies, reports a mortality of 36 per cent. In our series of 8 cases (5 nephrectomies, 2 incomplete operations, and 1 exploratory with removal of specimen), there was 1 death 8 days after operation, a mortality of 12.5 per cent. The fatality occurred following an incomplete operation; the tumor was exceedingly friable and was literally scooped away. The prognosis is very bad, most of the recurrences taking place within a year after operation. The mortality from operation and subsequent recurrences is between 86 and 93 per cent. In our series of 7 cases surviving operation, 4 died within 6 months of local recurrences, 1 died within the year; 1 patient, a girl of 22 years, is alive and well, 5 years after operation. This patient has lately gone through a normal pregnancy. Data could not be obtained of the other surviving patient.

### ADENOCARCINOMA

These tumors are rare. There were 2 cases in our series. In general, it may be stated that the disease is of much shorter duration than hypernephroma, and is decidedly more malignant. Instead of years, as in the latter condition, the course is often only a matter of months. The pain is much more constant and severe, the course of the disease more rapid, and cachexia appears earlier than in hypernephroma. Hæmaturia is more pronounced and the intervals between bleeding, shorter. The tumors do not attain the size of hypernephroma, but rapidly infiltrate and become adherent to the surrounding tissues. In the first case, the growth was situated in the upper pole of the kidney, and hard nodular glands were found in the region of the iliac vessels and aorta. The pathological report of the tumor was papillary carcinoma. There was a fatal termination of this case within the year. The second case had unusual features. The patient, a man of 54 years, was operated upon for a renal calculus which was removed through a pyelotomy incision. A small growth seen near the hilus of the kid-

ney was extirpated and reported papillary adenocarcinoma by the pathologists. A secondary nephrectomy was performed one week later. This patient is well now, one year after operation.

### PAPILLOMA AND ANGIOMA OF THE RENAL PELVIS

Tumors of the renal pelvis are rare. Israel reported 6 in his series of 126 cases of kidney tumors. Of 94 tumors at the Massachusetts General and Boston City Hospital, there was but one pelvic tumor, a papilloma. Binney (28) found 5 such growths in 105 cases. Albarran collected 42 cases, reported up to 1900. Judd (29) reports 3 in a series of 207 kidney tumors from the Mayo Clinic. The type of growth most commonly found in the pelvis is a papilloma, either malignant or benign. These tumors do not infiltrate the kidney tissue, but have a tendency to become implanted along the course of the ureter or in the bladder. The symptoms in general are those of renal tumor; hydronephrosis or hæmatonephrosis is frequently present. The diagnosis is seldom possible unless tumor cells are found in the catheterized specimens, or a growth is seen projecting from the ureteral orifice, or its immediate neighborhood. The association of a vesical tumor with renal hæmaturia is characteristic of this condition. Pyelography by demonstrating pelvic distortion and irregularity, should be of considerable value in the diagnosis.

In our patient, a male of fifty years, there was a history of recurrent bleeding for 18 months. The physical examination was negative. Cystoscopy revealed a small papilloma on the inferior lip of the sphincter, which was destroyed by means of high frequency treatment. The hæmaturia, however, persisted and on ureteral catheterization bloody urine was obtained from the left kidney. The patient died in the hospital from an apoplectic seizure. Postmortem examination showed a large papillary tumor in the pelvis of the left kidney. There were no ureteral growths. Pathological diagnosis: papilloma of pelvis of kidney, with implantation tumor of bladder.

The last case in this series is a most unusual one, in fact I have not as yet found its duplicate in the literature. The patient, a male adult, gave a history of intermittent hæmaturia, accompanied by right renal lumbar pain, of long duration. A tentative diagnosis of renal tumor was made. At operation, a normal sized kidney was found, with no evidences of a growth. The pelvis, which felt thickened, was then opened and disclosed a typical angioma, involving the whole of the pelvis and extending into the calyces. The growth was raised from the mucosa, and consisted of an irregular twisting mass of dilated blood vessels, presenting the appearance of a bunch of worms. In view of its extent, the angioma could not be resected, and nephrectomy was deemed inadvisable. The patient was seen about 5 years later, and except for a few attacks of bleeding, was otherwise well.

In conclusion I wish to call attention to the extreme malignancy of kidney tumors. Eleven of a total of 38 malignant growths were found to be inoperable. Twenty-seven nephrectomies were performed with 2 operative deaths, a mortality of 7.4 per cent; 23.3 per cent of the patients have passed the 3½-year period, whereas 58 per cent died within 2 years after operation, from recurrence or metastases. The only way to offset this high mortality is by early diagnosis and operation; this can be brought about by closer co-operation between the patient, general practitioner, and the surgeon.

ADDENDA. Since presenting this paper for publication four additional cases of tumor of the kidney have been observed, making a total of 44 renal neoplasms. The diagnosis was readily made in three instances, the classical symptoms of renal tumor (pain, tumor, hæmaturia) being present. The pathology of these growths was varied; one was a hypernephroma, one a sarcoma, the third a papillary carcinoma, and the fourth a papillary adenocarcinoma. All four patients were adults over 40 years of age. The case of hypernephroma presented unusual diagnostic difficulties, as there was no tumor palpable. The hæmaturia was intermittent in character and numerous hyaline and granular casts were present. As these findings had persisted more than a year, with no loss of weight, a

diagnosis of nephritic hæmaturia was made for which the patient was treated in a few hospitals. The diagnosis was made on the pyelographic data, and the attacks of bleeding produced by forcible manipulation of the ureteral catheter in the pelvis of the kidney.

All four patients were nephrectomized and made good operative recoveries. In the papillary carcinoma, it was found that the renal vein and the vena cava as far as could be palpated were completely thrombosed with tumor tissue. Such a finding is unusual for this type of tumor. This patient died a few months after leaving the hospital, the other three are alive and in good condition.

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# THE YOUNG–STONE OPERATION FOR URETHRORECTAL FISTULA

## Report of Three Cases[1]

By EDWIN G. DAVIS, M.D., F.A.C.S., Omaha

In 1913 Young and Stone (1) presented an operation for the radical cure of post-operative urethrorectal fistula, including reports of 3 cases. Four years later, in a second publication (2), they were able to add 8 more cases, making a total of 14, all but 1 of which were successful. In brief, the Young-Stone operation consists of a radical perineal dissection, the essential feature of which may be compared to an exaggerated Whitehead hæmorrhoidal operation, whereby a cuff of the rectum is dissected free and pulled down far enough so that amputation may be performed above the fistulous opening. Other important features of the operation are (1) suprapubic drainage, (2) urethral closure, and (3) the bringing together of fascia and levator fibers in the mid-line to act as a barrier between urethra and rectum.

Eloquent proof of the unsatisfactory results heretofore obtained by other less radical procedures is the number of previous operative attempts reported by almost all of the patients who presented themselves with this lesion. One case here reported had had eight attempts at closure, and, of the series of Young and Stone, six had had as many as three previous operations. The cure of urethrorectal fistula has been one of the most difficult problems in surgery, and it is for this reason that the rectum has always been a menace in any operation requiring perineal approach to the posterior urethra. The series of 11 cases reported by Young and Stone, together with the 3 herewith presented, makes a total of 13 successful cases out of a possible 14 — certainly a sufficiently high percentage to establish without question the

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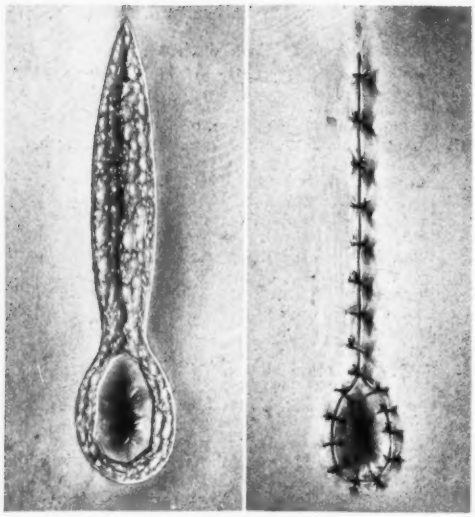

Fig. 1. The racquet-shaped incision beginning at the mid-point of the perineum and extending posteriorly encircling the anus at the mucocutaneous juncture.
Fig. 2. The final approximation of the skin.

merit of the Young-Stone technique. The articles describing this technique both appeared in strictly urological publications of rather limited circulation. In view of this fact, and contrasting these splendid results with the notoriously poor results heretofore obtained, it seems worth while to call the attention of the general surgical profession to the value of this operation.

It is to be noted that the type of case under consideration does not include those fistulæ of tuberculous or cancerous origin, but only those occurring as the result of surgical trauma. Of the total of 14 cases, 2 resulted from perineal lithotomy, 5 from drainage of a prostatic abscess, and 7 from perineal prostatectomy. The diagnosis is very simple. The characteristic feature is, of course, passage of gas *per urethram* and urine *per rectum*, which, coupled with the history of a previous perineal operation, leaves little doubt as to the condition. The diagnosis is confirmed by rectal examination, revealing an opening in the mid-anterior rectal wall, within 1 or 2 centimeters above the sphincter ani, and communicating directly with either the membranous or the prostatic urethra, usually the former. Rectum and membranous urethra are normally so closely approximated that the length of the fistula is never more than 3 or 4 millimeters. All of the cases presented extensive perineal scarring, both superficially and deep, particularly those which had passed through numerous operations; and more than half were complicated by the presence of a communicating perineal fistula. Five had in addition partial incontinence of fæces due to a division of the sphincter ani, and 3 had urinary incontinence on account of an injury to the internal vesical sphincter. During the cystoscopic examination of one of these latter, the dilated sphincter made it possible to withdraw the cystoscope into the posterior urethra and obtain a view of the fistulous opening into the rectum. Considering the extensive scarring always present, and the various complications presented by communicating perineal fistulæ and by damaged bladder and rectal sphincters, the operation in each case was undertaken under most discouraging conditions.

## OPERATIVE TECHNIQUE

*Suprapubic.* The simplest portion of the operation, but not the least essential, is suprapubic cystostomy, performed to protect the perineal sutures from urinary infiltration and muscle spasm. In 2 cases of the Young-Stone series, and in 1 case reported below, there was urinary incontinence, due to a damaged vesical sphincter, which it was possible to repair successfully through the suprapubic incision, according to a technique later described by Young (3). In these cases the Davis vacuum drainage apparatus (4) was of advantage in keeping the bladder dry and preventing urinary leakage through the perineum.

*Perineal.* A clear idea of the technique of the perineal dissection is best obtained by a study of the illustrations.[1] With the patient in the exaggerated lithotomy position, a racquet-shaped incision is made, extending from the mid-point of the perineum downward, including the communicating perineal fistula if such exists, and encircling the anal opening

[1] The original illustrations were kindly loaned by Hugh H. Young.

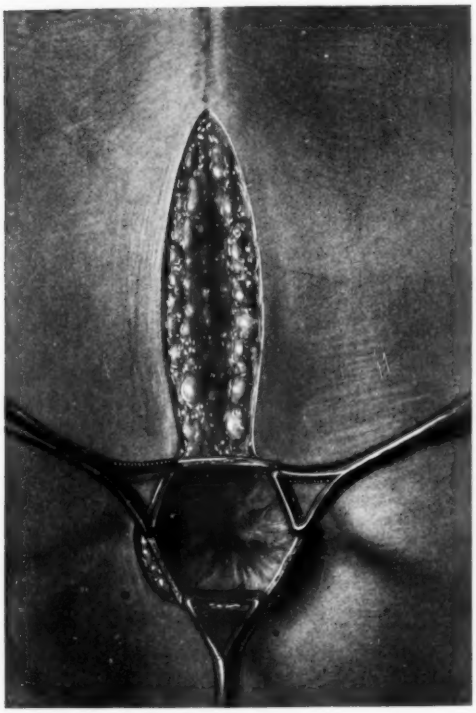

Fig. 3. The first step in the freeing of the rectal mucosa from the underlying structures.

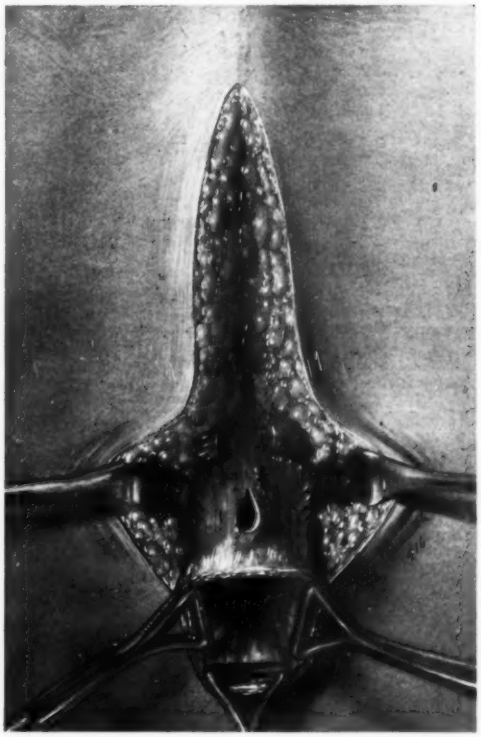

Fig. 4. The mucosa has been freed to a point well above the fistulous opening and the sphincter ani muscle has been divided.

at the mucocutaneous juncture (Fig. 1). A dissection of the rectal mucosa is then begun, freeing a cuff of the latter and pushing back the sphincter as in the Whitehead operation for hæmorrhoids (Fig. 3). To begin the operation in this manner discloses cleavage planes which are of great assistance in the next stage which consists of freeing the rectum anteriorly where it is involved in dense scar tissue and intimately associated with the urethra. It is at this stage that the greatest difficulty is encountered. To separate the rectum and urethra without injuring either, and then to continue the dissection through scar tissue as far back as the base of the prostate, peeling back the rectum from the prostatic capsule without the aid of the cleavage plane, normally offered by Denonvillier's fascia, requires great patience and at best is unavoidably time-consuming. Yet, if the operation is to be successful this dissection must be continued, despite difficulty, high enough to mobilize a sufficient length of rectum so that amputation of the fistula-bearing cuff may be performed, leaving a normal rectal stump, which may be sutured flush with the skin edge, *without tension*. The procedure is facilitated by a deliberate division of the sphincter ani anteriorly (Fig. 4). The dissection is then completed by a thorough exposure of the urethral opening which may involve the membranous urethra only, or which may extend well back into the prostatic urethra (Fig. 5). Closure is now a relatively simple matter (Fig. 6). As important as the closure of the urethra itself is the bringing together in the mid-line of fascia and levator ani fibers, making a

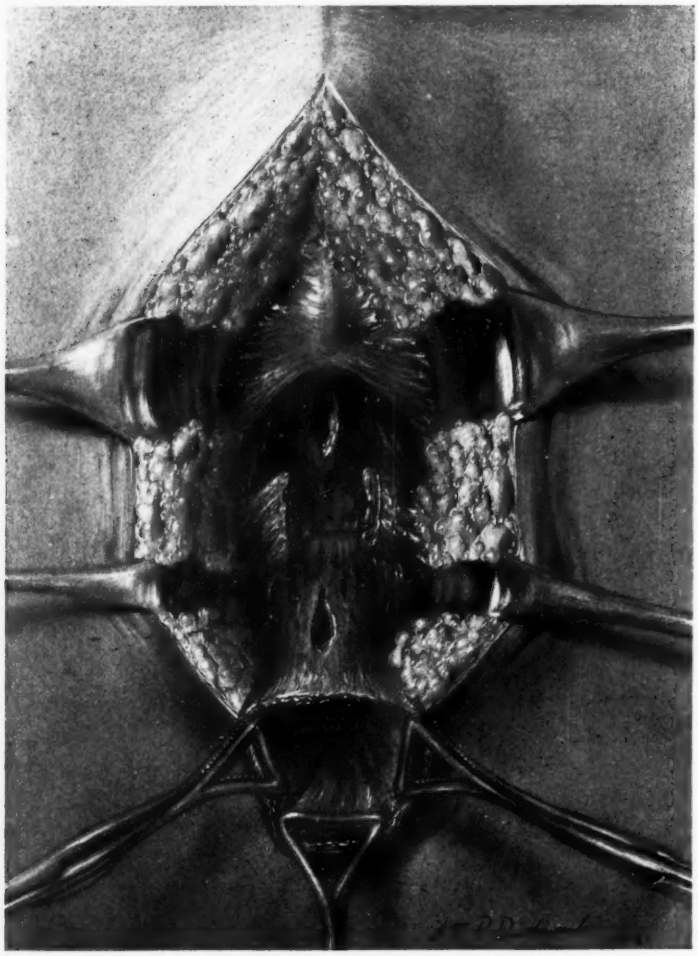

Fig. 5. The dissection has been carried down through the perineal body and the urethral orifice of the fistula exposed.

second layer over the urethra, and completely separating this structure from the rectum. In those cases where the sphincter ani has been previously divided, scar tissue may cause difficulty in the isolation and repair of this structure (Fig. 6).

The final stage of the operation is the amputation of the rectal cuff (Fig. 7) and the suture of the rectal stump to the circular skin edge, anchoring the former in place by four quadrant subcutaneous sutures.

## CASE REPORTS

CASE 1. J. E., age, 30. The history of this case dated back to an operation, which was apparently a perineal lithotomy, performed 8 years before admission. Since that date there had been passage of gas *per urethram* and urine *per rectum*. On account of a damaged internal vesical sphincter, patient was able to retain only small amounts of urine in the bladder, and this only when in a recumbent position. To complicate matters further, there was a communicating perineal fistula through which about one-half of the urine drained. Patient stated that there had been eight previous operative

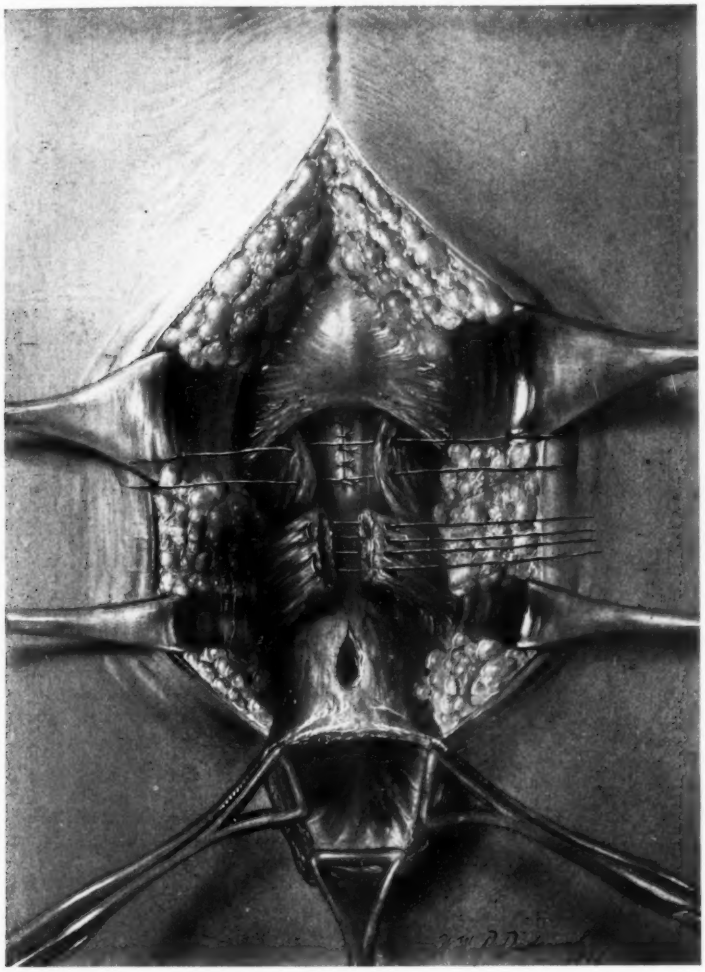

Fig. 6. After freshening its edges, the fistulous opening in the urethra is closed and the perineal musculature is brought together with interrupted sutures. The cut edges of the sphincter ani are approximated.

attempts at closure. On account of prolonged suffering he had become an habitual user of morphine.

Examination showed a depressed, scarred perineum with a mid-line fistula. *Per rectum* there was palpable anteriorly an opening large enough to admit the finger tip, communicating with the urethra at the apex of the prostate. The edges of the opening were sharp and well-defined and densely infiltrated with scar tissue. Cystoscopy showed a dilated internal vesical sphincter, which permitted withdrawal of the cystoscope into the posterior urethra, allowing a view of the verumontanum and, still lower, the fistulous opening into the rectum. In the suprapubic region there was also the scar of a previous suprapubic cystostomy. In spite of the patient's prolonged illness and many operations his general physical condition was good.

Operation was performed on February 10, 1920. The suprapubic incision was complicated by the previous scar in this region and adherent peritoneum. The bladder was found to be about normal in appearance except that the internal vesical sphincter stood widely open so as to permit a view into the

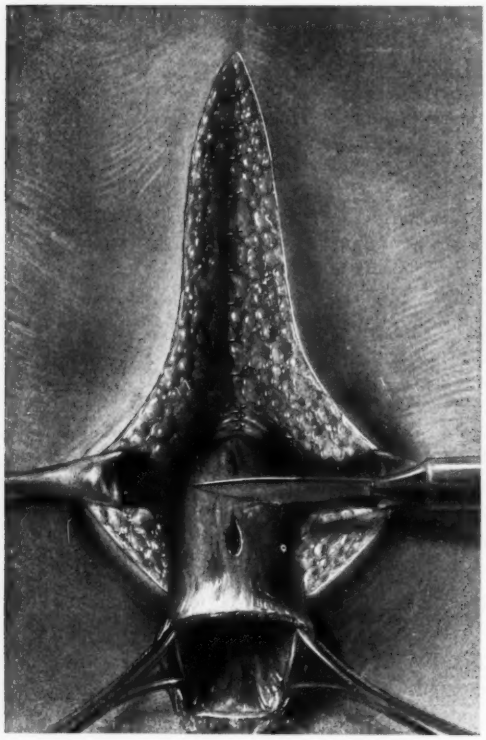

Fig. 7. The final stage of the operation consisting of the amputation of the cuff of mucosa containing the fistulous opening, after which the lower end of the rectal tube is united to the anal skin margin.

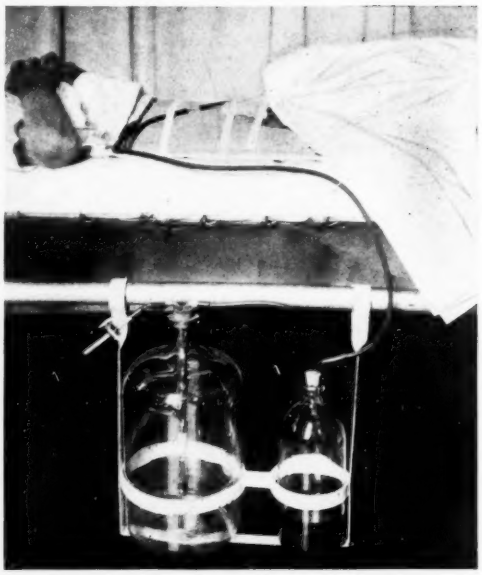

Fig. 8. Davis vacuum apparatus for maintaining suprapubic drainage. The larger bottle, the air from which is exhausted with a laboratory filter pump every 48 hours, maintains a very slight but constant suction within the urine bottle, through a minute communicating capillary tube. The amount of suction is regulated by an automatic mercury manometer. The bladder is kept empty, and the incision clean and dry.

posterior urethra. According to the technique described by Young (3), an incision was made posteriorly at the prostatic margin and two sutures of chromic catgut inserted so as to approximate the tissues in this region and close the relaxed orifice. The patient was then changed to the lithotomy position and the perineal dissection carried out. The opening in the rectum in this instance was so large that a soft rubber catheter, passed into the urethra, entered the rectum instead of the bladder. A great deal of difficulty was encountered on account of dense cicatricial tissue, both in the neighborhood of the fistulous opening and farther back between the prostate and rectum and firmly uniting these two structures. Of course, the cleavage plane normally offered by Denonvillier's fascia was obliterated and in peeling back the rectum it was necessary to take with it a small portion of the prostatic capsule. Closure was as described above. Patient left the table in good condition.

Convalescence was uneventful. Suprapubic drainage was maintained with the Davis vacuum drainage apparatus for 9 days, after which the tube was removed and the suprapubic fistula allowed to close. This took place after 4 days. The only complication worthy of note was an abscess which developed in the perineal suture line, which was opened on the fifth day and drained a small amount of pus. Following removal of the suprapubic tube patient voided normally, there being slight leakage of urine through the perineal wound for 3 or 4 days, after which this incision remained healed and dry. Sounds (26-F) were passed on the fourteenth day after which the patient was discharged from hospital.

Three months after operation a letter from the patient stated that he was voiding freely at normal intervals and had no incontinence of either urine or fæces.

CASE 2. R. D., age, 32. Following an old neisserian infection, patient developed in 1919 what seems to have been an acute prostatitis, perhaps a prostatic abscess. A perineal operation was done for this condition, after which the patient was told that there had been no abscess but that it had been necessary to remove the prostate. Symptoms of a urethrorectal fistula appeared a few days afterward and this condition persisted in spite of two subsequent operations, one of which was a plastic opera-

tion which closed the openings both in the urethra and the rectum, and the other, simple division of the sphincter ani which resulted in directly uniting the rectum with a communicating perineal fistula. When first seen, patient was passing practically all of the urine through the perineal fistula.

Examination showed a markedly scarred perineum and a mid-line fistula just anterior to, and communicating with, the rectum. The sphincter ani was divided, causing partial incontinence of fæces. On rectal examination, the rectal fistula was not palpable as a hole, since all of the intervening tissue had been divided at the last operation.

Operation, April 3, 1920, did not differ essentially from the routine operation described above. Suprapubic cystostomy was first performed. The perineal dissection was complicated by the previous division of the sphincter ani and the involvement of the divided ends of this structure in dense scar tissue. The rectum and urethra were separated and it was found that the fistulous opening extended back about 1 centimeter into the prostatic urethra. Closure as above described. In uniting the divided ends of the sphincter ani, it was necessary to include scar tissue in the sutures and it was considered at the time that possibly the sphincter had been made a little too tight.

Convalescence was uneventful except for pain and discomfort caused by the suprapubic drainage tube which was removed on the ninth day. Following this, patient passed a good portion of the urine through the perineal incision. Perineal drainage, however, gradually diminished and ceased entirely at the end of 3 weeks. Suprapubic incision closed after 2 weeks. Sounds (26-F) were passed at the end of 3 weeks without difficulty.

When last seen, 6 months after operation, the perineal fistula was entirely dry and patient was voiding normally at normal intervals.

Case 3. J. S., age, 62. Patient's general health had been good up to the development of urinary difficulty in about 1917. Perineal prostatectomy was performed in December, 1919, followed by the development of a urethrorectal fistula.

Examination showed a perineum less scarred than the average. There was a small cummunicating perineal fistula through which about 50 per cent of the urine was voided. *Per rectum*, there was palpable a large communication between the rectum and membranous urethra, easily admitting the finger tip and extending back into the prostatic urethra. General condition good.

Operation, April 7, 1920, was performed according to the routine technique. After establishing suprapubic drainage, the perineal dissection was carried out in the routine manner. This dissection was somewhat easier in this case because the patient had had only one previous operation and the tissues were not as distorted as usual. The sphincter ani, which was entirely normal, was deliberately divided in the mid-line. The urethra was closed with interrupted sutures of chromic catgut and over this fibers of levator ani were united. The sphincter ani was repaired and final closure made as described above.

Convalescence was entirely uneventful. Following removal of the suprapubic drainage tube, there was no perineal leakage whatever, and the suprapubic incision closed within 2 days. Patient began voiding normally on the twelfth day and left the hospital on the fifteenth day.

Seen 6 months after operation, patient was voiding normally at normal intervals and was entirely well in every respect.

This paper is intended merely to emphasize the value of the Young-Stone operation, and does not include a summary of the previous literature. For this, and for a discussion of the various other methods, the reader is referred to the publications of Young and Stone.

Urethrorectal fistula is not a menace to life. Yet, the patient is almost totally incapacitated, particularly if his condition is complicated by a communicating perineal fistula, or by a damaged vesical or anal sphincter, which was the situation in 10 out of 14 cases. After months or even years of a miserable existence, barred from ordinary occupation, barred from society; and after two or three unsuccessful operative attempts, it is not strange that the patient should become depressed or mentally unbalanced. Two of the three here reported had contemplated suicide. Emphasis is here laid upon the serious condition of these patients, in reply to the possible criticism that the above operation is a very extensive surgical procedure, undertaken for the cure of a lesion which might seem relatively insignificant. The percentage of reported successful Young-Stone operations (93 per cent) is sufficient to justify a promise to the patient of a cure, with the ordinary reservations for surgical mishaps. The operation, then, offers a satisfactory *dependable* method of cure, which may be said of no other less radical procedure.

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# SURGICAL TREATMENT OF SUPPURATION IN POSTERIOR MEDIASTINUM

## Report of a Case[1]

By WILLIAM LERCHE, M.D., F.A.C.S., St. Paul, Minnesota

In the literature there are reported but few cases of the type which is considered in this paper, that is cases in which suppuration originates in the neck and extends into the mediastinum and which are treated by drainage of the posterior mediastinum by the cervical route. The case presented below was operated upon in 1907. Up to that time we find but 8 cases reported in the literat ire, namely: two cases of von Hacker (1) 1901; and 6 cases that Hacker had collected (Luermann, 2, 1876; Ziembicki, 3, 1895; Obalinski, 4, 1896; Cavazzani, 5, 1899; Heidenhain, 6, 1899, and Rasumowski, 7, 1900). Gaudiani (8) published 2 cases in 1916. In Obalinski's case the abscess of the neck was incised, but no surgical treatment of the mediastinal suppuration was undertaken during the life of the patient. At postmortem, however, a posterior mediastinotomy was done. The case, therefore, should properly not be grouped here.

On August 26, 1907, I examined Mrs. R. T., age 50 years. She had had a dry catarrh of the nose and throat for many years. For 6 years preceding the examination, the patient had had a peculiar, hard, metallic cough, which frequently became paroxysmal in character. For about the same length of time she had had periodical attacks of dysphagia in which food would stick in the gullet, so that she had to force it down with liquids. There had been no regurgitation, but she had suffered severe pain behind the lower part of the sternum before food passed into the stomach.

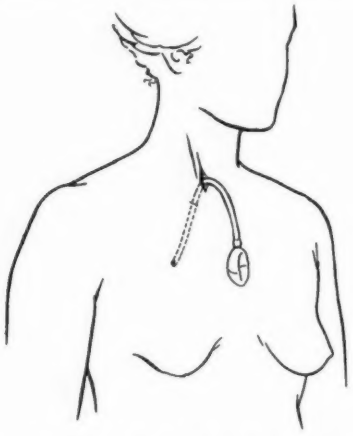

Fig. 1. Bulb attached to drainage tube which patient adjusted for suction.

In the last few months prior to the examination, the attacks had increased greatly in frequency and the last one had been of several weeks' duration. She had to limit herself to liquids and even those would cause much pain behind the sternum. She had lost 10 pounds in weight.

Examination showed an atrophic rhinitis, and the pharynx had a dry, glazed appearance.

The œsophagus was empty but somewhat dilated and the epicardia-cardia was seen in spasm in one of the three œsophagoscopies made. The cervical part of the œsophagus had the same dry, glazed appearance as the pharynx. The dysphagia and the spasms of the œsophagus gradually grew worse, and on October 5 the patient had a temperature of 102° and pulse 110, with swelling and tenderness of the lower right side of the neck. October 7 small quantities of pus were gulped up.

October 8 an incision was made 10 centimeters in length along the anterior border of the sternocleidomastoid muscle to the sternal notch. When the right lobe of the thyroid was retracted toward the mid-line, a large abscess cavity was disclosed behind it, between the œsophagus and the trachea on the inner side and the sternocleidomastoid muscle and the large vessels on the outer side.

The abscess could be followed into the superior and posterior mediastinum for about 9 to 10 centimeters below the top of the sternum. A rubber drainage tube was left in the mediastinum, the rest of the abscess cavity packed with iodoform gauze, and the patient put to bed in Trendelenburg's position. The following day a siphon drain was arranged with the patient in the horizontal position. Later a soft rubber bulb (Fig. 1) was attached to the drainage tube, which the patient now and then adjusted for suction. The wound healed in 7 weeks.

Although there were small quantities of pus gulped up the day before the operation, there was at no time any evidence of œsophageal fistula.

The etiology of the case is of interest. The peculiar cough and periodically recurring attacks of dysphagia of 6 years' standing, the

Read before the American Association for Thoracic Surgery, New Orleans, May 1, 1920.

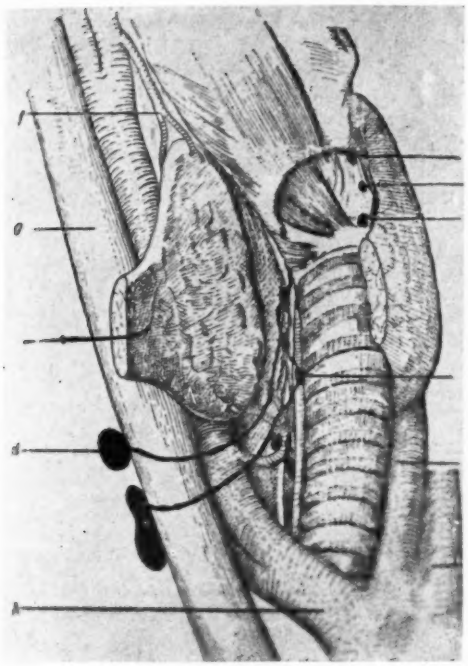


Fig. 2. *c*, Lymph nodes of recurrent chain. *d*, Lymph nodes of external jugular chain. (After *Rouband*.)

Fig. 3. Roentgenogram of cadaver showing extension of barium injection into upper part of groove between œsophagus and trachea.

increasing severity of symptoms in the 3 to 4 months preceding the operation, with the final formation of the large abscess, followed by complete cure, without the slightest return of any laryngeal or œsophageal symptoms, in the thirteen and a half years following the operation, suggest a local nerve irritation. The explanation is probably that the right recurrent chain of lymph nodes (Fig. 2) had become infected and caused irritation of the recurrent laryngeal nerve, situated in the groove between the trachea and œsophagus, supplying the larynx and sending twigs to the trachea and the œsophagus.

The recurrent chain of lymph nodes receive the lymph trunks that drain the upper end of the œsophagus, and the already chronically inflamed mucosa of the upper end of the œsophagus was probably the avenue of entrance of the infection.

In several of the reported cases the pus was found in the retro-œsophageal space, extending into the posterior mediastinum. In my case the pus was not retro-œsophageal, it probably followed the groove between the œsophagus and trachea. However, no mention was made in my record of the exact point of entrance.

In order to get information about the probable route taken by a liquid mass introduced into the upper part of the groove between the œsophagus and trachea, I injected into that area in fresh cadavers, barium suspended in buttermilk. With moderate, gradually increasing force, the liquid mass was found to extend laterally along the œsophagus and trachea into the superior mediastinum, extending a few centimeters below the tracheal bifurcation into the posterior mediastinum. It also followed the vessels, and when greater force was used, it crossed in front of the trachea to the opposite side. Roentgenograms were taken (Fig. 3).

It may be of interest to mention here that in dressing the patient, I repeatedly intro-

duced an endoscopic tube into the mediastinum, and, while the patient swallowed milk I observed the rapid peristaltic wave of the œsophagus.

The number of cases thus far operated upon (including that of the writer's) is 10, 6 of which made complete recovery after cervical mediastinotomy. In one case, that of Cavazzani, dorsal mediastinotomy was added after 3 months of drainage by the cervical route.

Three out of the ten cases died. In view of this, the dictum of Ziembicki, that every case should be drained both by the dorsal as well as the cervical route, can hardly be accepted. If, however, cervical mediastinotomy should prove insufficient, it should be supplemented by dorsal drainage.

Several methods of approach in dorsal mediastinotomy have been described. The difference in the various operations consist mainly in the placing of the incision or the flap, and in the treatment of the ribs, the object in all being to separate the pleura from the ribs and vertebral column in order to gain access to the posterior mediastinum. Nassilow, Quénu and Hartmann, Rehn, Bryant, and others placed the incisions at some distance from the mid-line with more or less extensive resection of ribs, while Heidenhain's incision is close to the mid-line. He separates the fibers of the thick muscle layer and resects one or more transverse processes with a small part of the attached rib. If more space is needed, a cross incision may be added. I have performed this operation on the cadaver, and, as there is probably less liability of tearing the pleura, the Heidenhain operation would perhaps be the one of choice in the draining of the mediastinal abscess.

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# THE DIFFERENTIATION OF SAPHENOUS VARIX FROM FEMORAL HERNIA

By DE WITT STETTEN, M.D., F.A.C.S., New York

IT is well known that the not uncommon dilatation of the terminal portion of the saphenous vein near its entrance into the femoral is frequently mistaken for a femoral hernia. This dilatation is sometimes found of considerable size and, when the patient is standing, may easily be seen as a protruding mass in approximately the location of a hernia through the femoral canal (Fig. 1). It is often painful and symptomatically very readily suggests such a hernia.

De Quervain (1) passes over the diagnostic difficulties rather lightly and concludes that a confusion between the two conditions is almost unthinkable. The main points of differentiation according to this author are, in the case of saphenous varix, a bluish sheen to the skin over the swelling, easy compressibility and prompt reappearance upon release of pressure, and fluctuation in size with every change in the venous pressure from coughing, vomiting, and even lying down or normal breathing.

In spite of the clarity of these directions and the apparent simplicity of diagnosis, these aneurismal dilatations of the upper part of the saphenous vein are regularly diagnosed and operated on as femoral herniæ, even by very careful observers. The bluish appearance is absent if the subcutaneous fat is at all pronounced. The compressibility is often just as marked in a hernia. The enlargement with the increase in venous pressure as in coughing, or the disappearance on lying down, are not very unlike the hernial impulse on straining, on the one hand, and the spontaneous reduction of the rupture in the recumbent position, on the other. I have seen a number of these cases in which either the error in diagnosis was deliberately made or where the diagnosis was doubtful until the lesion was exposed at operation. Some years ago Coppernail (2) reported a case in a woman who had what had been regarded as a reducible, right femoral hernia for 20 years. The mass suddenly became painful and irreducible. Accompanying this change, there was repeated vomiting of a fœtid character, obstipation, and tympanites. A diagnosis of strangulated femoral hernia was promptly made, and an immediate operation performed. The apparent strangulated femoral hernia turned out to be a thrombosed saphenous varix.

Quite recently I was consulted regarding a case of so-called recurrent, left, femoral hernia, which had been operated on some months previously. The sac had not been found, but a careful plastic by the Lotheisen method had been done. A recurrence was noted almost as soon as the patient got out of bed. Re-operation for the hernia had been advised and was about to be carried out when I saw the patient. The diagnosis was made of a saphenous varix, which I excised (Fig 2).

In addition to those signs mentioned by De Quervain and referred to above, there are a few points in the differentiation of these two conditions, which I believe might aid in the diagnosis.

The position of the swelling in the dilatation of the upper part of the saphenous vein is usually somewhat lower down than in the case of a femoral hernia. This dilatation, while it may be at the saphenous opening, just at the entrance of the internal saphenous into the femoral vein, is generally a centimeter or two below the junction. In the case from which the specimen illustrated was taken, there was an interval of nearly 2 centimeters between the sacculation and the opening into the femoral.

As a rule other varicose veins will be found on the leg and thigh if a dilatation exists near the saphenous opening. When the patient stands, the internal saphenous vein itself is generally very evident as a distended vessel running between the inner posterior aspect of the knee to the aneurismal sac.

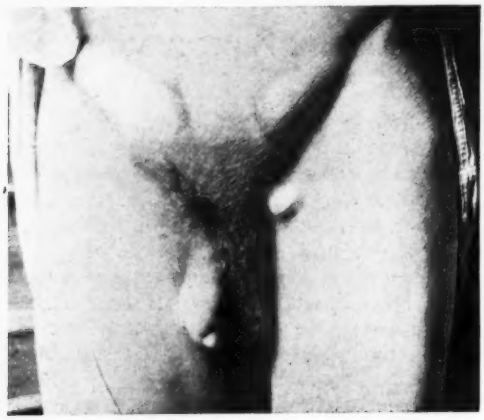

Fig. 1. Case of saphenous varix simulating femoral hernia.

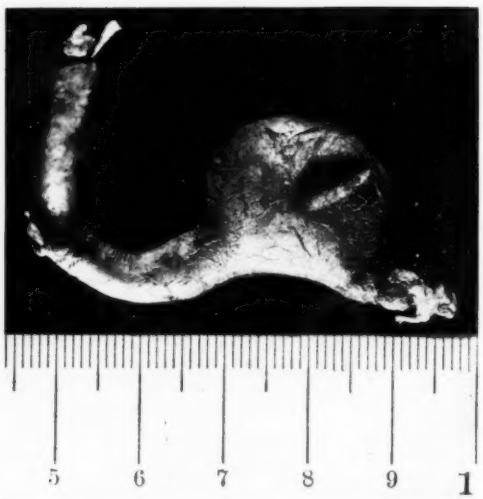


Fig. 2. Specimen from case of saphenous varix, which had been diagnosed and operated upon as a femoral hernia. Re-operation for recurrence had been advised.

Reduction of the tumor and pressure over the femoral ring by the examining finger does not hold back a saphenous varix which reappears if the patient strains or stands. Finally the impulse on coughing differs materially in the two conditions. Instead of a frank impulse as in a hernia, there is, in the venous dilatation, a fluid wave or thrill. This is readily elicited if only light pressure is made during the examination. This last sign is almost pathognomonic. It can be simulated in hernia only if there is a coexistent ascites, which is readily recognized. Coley (3), in his article on hernia in Keen's *Surgery*, also emphasizes the last three mentioned differential points, namely: in saphenous varix, the presence of other varicose veins, the recurrence of the swelling even when the hernial orifice is compressed, and the fluid thrill as distinguished from the hernial impulse on coughing.

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# RECONSTRUCTION OF THE HAND

## A New Technique in Tenoplasty

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IN THE treatment of traumatisms and infections which impair function, from an industrial and wage earning standpoint, it will be granted that the hand comes next in importance to the brain and eye (Fig. 1). It was with this thought in mind that the present investigation and research were instituted in an endeavor to better, if possible, the technique involved in the restoration of the function of the hand. Such restoration includes, of course, lesions of the fingers, hand, wrist, and forearm, and involves changes in the skin, fascia, palmar spaces, bursæ, nerves, bones, articulations, ligaments, muscles, or tendons or all of these.

The chief factors which produce impairment of function in the hand are infections, penetrating wounds, and deep burns. To this list must be added operative traumatism, as every surgeon of experience has encountered cases in which the most scrupulous and apparently aseptic technique has been observed and primary healing has followed, but as an end-result, adhesions have formed or contractures occurred from operative traumatism, which vitiated perfect restoration (Fig. 2).

In a paper of this scope, it is not possible to cover the detailed treatment of each of these disabilities, except by a brief reference to the mode of procedure employed in certain cited cases. Chief attention will be paid to lost function in the tendons.

Even from the standpoint of restoration of function in the tendons, much depends upon the previously correct diagnosis of the original lesion and initial treatment or maltreatment. Many seriously deformed hands from lacerations and infections are the result of needless incisions in the wrong place or dilatory incisions in the right place. In some of such cases, perfect functional restoration is next to impossible. It, therefore, follows that much restoration later may be avoided, if the original treatment is on scientific lines. A correct knowledge of proper early treatment of the various affections and injuries to this member is pointed out in Kanavel's *Infections of the Hand*, that valuable and useful book to all who are called on to do accident surgery of the upper extremity. Thus a hand or forearm presenting a lymphangitis must be treated entirely differently from a tenosynovitis and so must fascial space and bursal infection. As Kanavel says:

"The location of the greatest swelling comes in those areas where there is the largest amount of loose cellular tissue, i.e., upon the dorsum, while in nine cases out of ten the pus is on the flexor surface.

"The site of the greatest tenderness is of marked importance in the location of the pus.

"The treatment of the three types is essentially different and the gravest error will be made, if they are not differentiated, since their treatment is diametrically opposed."

Briefly stated:

a. Lymphangitis shows little locally except at the site of the invasion and streaks along the lymphatics on the *dorsum* of the hand and forearm, but, is manifested chiefly systemically by the fever and malaise of infection. Indiscrimate incision in such cases is not only not indicated, but positively harmful. Hot dressings, preferably saturated with boric solution, rest of the part locally, and systematic elimination must be relied on chiefly, until the acute symptoms subside.

b. Tenosynovitis is shown by exquisite tenderness over the *course* of the sheath and limited to the sheath and increased pain on extension, especially proximally. In such cases under *general anæsthesia*, preferably nitrous oxide and oxygen, and *in a bloodless field* the tendon sheaths should be freely opened *laterally, not centrally*, with care to preserve so far as possible the fascial sheaths that act as pulleys at the flexures of the fingers, and should be dressed with vaseline gauze.

Fig. 1. Both hands rendered useless by destruction of carpus, ankylosis, and binding down of tendons in scar tissue.

c. Palmar, thenal, and hypothenal space infections and radial and ulnar bursal involvement, often secondary to neglected tenosynovitis, should be carefully differentiated and freely incised in the proper location to secure maximum drainage and avoid vessels and nerves. Kanavel recommends the continuance of the bloodless bandage after operation, sufficiently tight to produce passive congestion for 24 hours, and thus allow slow absorption of toxins.

Fig. 3 (above). The second instrument devised as a tendon clamp, by the author.
Fig. 4. The third type of tendon clamp devised.

Fig. 2. Contracture of finger following "traumatic surgery," which resulted in adhesion in tendon sheath.

Too great conservatism is as dangerous in early treatment as radical indiscriminate surgery, for the reason that in the former, undue delay permits extension of the infection from one region to the other, as the latter may cause unnecessary infection and destruction of tissue or function in opening up uninvolved areas. A good rule is to be sure of the chief and primary location of pus, incise and follow up its extension to other spaces and bursæ by additional incisions to secure free drainage, if necessary.

As pointed out by Willmes, early passive and active use will help to force pus out of adequate incisions and promote return of function. The surgeon with gloved hand may accomplish this manipulation with less pain to the patient, if the latter's hand is immersed in hot water.

Unfortunately, many cases presenting themselves to the reconstructing surgeon are samples of previously bad jobs with not only ruthless disregard to ultimate function, but evidence of ignorance of anatomical pathology.

In addition to this, some reconstruction with an aim at functional restoration is marred by what may be termed traumatic surgery or what has been previously spoken of as "operative traumatism." By this is meant the unnecessary wounding of tendon structures during operation, drying out, having the skin incision directly over the line of repair of a tendon-sheath or tendon, leading to adhesions and contractures, so as to vitiate *partially or wholly* the entire operative procedure, just as surely as a break in an aseptic technique with infection would.

### PREPARATION FOR TENDON OPERATIONS ON THE HAND OR FOOT

The writer has had more perfect results in tenoplasty by resorting to the old method, rather than by the popular and generally

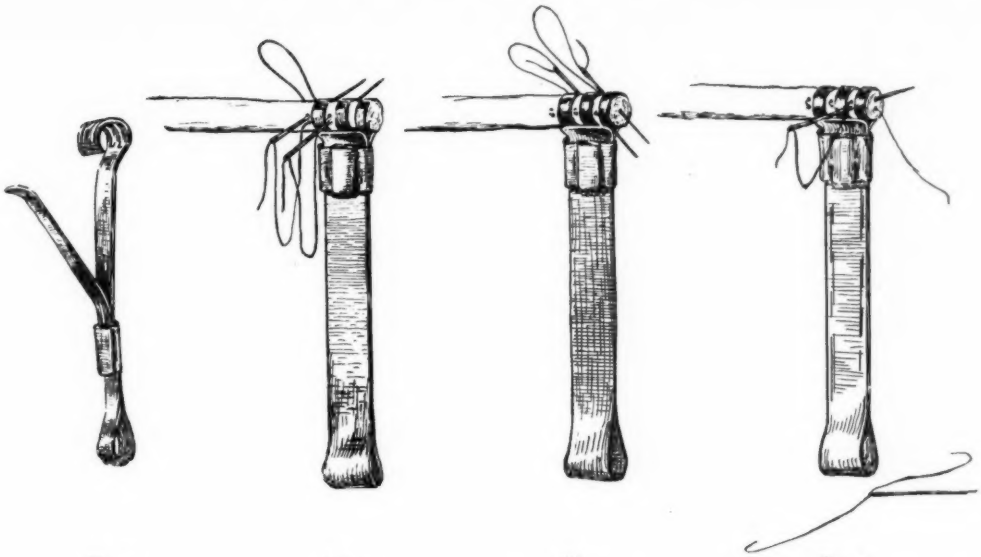

Fig. 5. Fig. 6. Fig. 7. Fig. 8.

Fig. 5. The author's accepted type of clamp made of clock spring.

Fig. 6. Silk threaded in two needles showing transfixation of tendon to left of clamp. After the thread is passed obliquely on its return from the far side back to the near side in the first fenestrum, it is passed obliquely to the far side in the second fenestrum. (The writer's technique.)

Fig. 7. Needle passing from the far side of the second fenestrum to the end of the tendon.

Fig. 8. The second needle passing from the near side of the second fenestrum through the end of the tendon.

used iodine and alcohol method of skin sterilization.

The older method referred to is the preparation 24 hours in advance of the operation, *i.e.*: (1) green soap scrub and shave; (2) application in turn of (a) permanganate of potassium solution (3 : 100), (b) oxalic acid solution (3 : 100), (c) ether, (d) alcohol, (e) bichloride of mercury (1 : 5,000) solution, applied on wet towels from finger tips to axilla until patient is etherized and operator is ready to begin.

### BLOODLESS FIELD

It is hardly necessary to mention that this work should be done in a bloodless field to secure clear recognition of the parts and to avoid the necessity of sponging, which, if required, should be done with *moist absorbent cotton* and *not wiped with gauze*. After applying the rubber bandage with uniform firm pressure from the hand to the elbow, the round U. S. Army constrictor should be applied by four turns, making a wide band above the internal condyle of the humerus which region is covered by a gauze handkerchief to protect the ulnar nerve. With this technique, danger of pressure paralysis is remote and almost negligible.

Skin incision should not be over the point of the desired tendinous union. As previously stated, a crescentic or semi-circular flap should be dissected back at the beginning of the operation, so that the point of tendinous

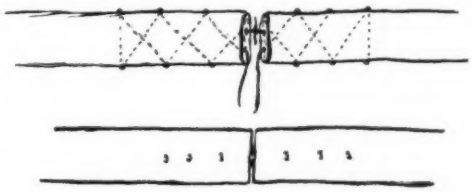

Fig. 9. Above, diagram shows the course of the silk through the tendons and end-to-end tying. Below, lateral view of end-to-end approximation of tendons. Dots of silk are the only evidence of this method of suturing.

Fig. 10. Tendon clamp applied to the sublimis of the third finger of the right hand. Suture *in situ* and ready for transplantation. On the left is shown the wet pledget of cotton, which, in practice, is spread over the tendons except at the point where work is actually being done, to prevent drying out of the tendons. The sheath of the sublimis is shown attached to distal end of severed tendon.

Fig. 11. The proximal end of the sublimis tendon with suture *in situ* is here shown approximated to the distal end of the profundus tendon of the index finger by means of the tendon clamps as instrumental knotting of the silk sutures is effected. As in Fig. 10 the wet cotton is here also gathered in a mass as otherwise it would obscure the relationship of the parts.

union should not lie under the line of suture of the skin for fear of being caught in the skin scar and interfering with ultimate function.

### PROTECTION OF FIELD OF WORK FROM DRYING DURING EXPOSURE

Soon after the tendons in question are exposed, bits of absorbent cotton wet in a bowl of normal salt solution should cover the field of work as far as possible to keep the tissues moist.

Sterling Bunnell[1], of San Francisco, applied the term "atraumatic technique" to tenoplasty in sewing tendons end-to-end and devised an instrument of thin metal which might be wrapped around the tendon's end to facilitate handling and not traumatize, as rat-tooth or mouse-tooth forceps or even a hæmostat would, if the tendon during the operative procedure was held by it. Bunnell's tendon clamp consists of two parts and really three procedures are involved in its application. One piece, a strip containing two fenestra in the center, first is folded over the tendon and held in place; second, a slide of the same metal like the sliding keeper of a belt to hold the tendon securely in the strip, is put on. The slide is then held in place by a hæmostat as the third procedure. It has seemed to the writer that in a large number of cases these three procedures would be greatly facilitated by the use of one instrument fenestrated for suturing and for grasping without traumatism, and entail the possibly unsurgical manual handling of the tendon, which procedure is especially dainty, tedious, and time-consuming in applying the minute slide over the two ends of the tendon-holding strip of thin metal now doubled over the tendon.

[1] Surg., Gynec. & Obst., 1918, xxviii, 103-110.

Fig. 12.

Fig. 13.

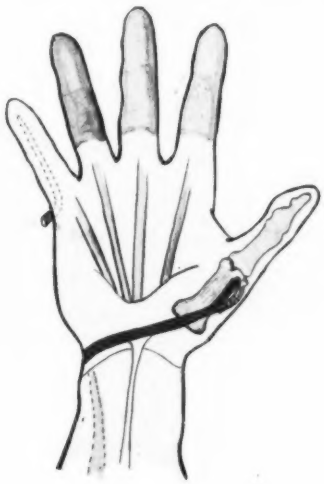

Fig. 14.

Fig. 12. Diagrammatic drawing of the tendons of the hand showing the sublimis tendons cut across and removed from the palm and the profundus tendons exposed.

Fig. 13. Diagrammatic drawing of the back of the hand showing that there are normally two extensor tendons attached to the first, second, and fifth fingers.

Fig. 14. Cook's method of utilizing extensor tendon of little finger to effect flexion and adduction of thumb.

### THE NEW INSTRUMENTS

Accordingly, the writer had pieces of equal size of thin, flat German silver soldered on the ends of minute mosquito hæmostats and curved in varying degrees to grasp tendons of varying sizes, and dentated so that when closed centrally the intervals between the dentates would become fenestra through which sutures could be passed. These instruments after repeated use demonstrated that the very thin metal would bend and prevent close central approximation of the dentates and would cause the suture material, fine intestinal silk, to catch on the projecting dentates.

The next instrument devised was a dentated crook-like piece made of steel attached to one blade of the mosquito clamp with a trident on the other to coapt laterally and not centrally. Sutures were more readily applied with this, but still, silk occasionally caught and retarded the operative procedure (Fig. 3).

Next, a similar crook-like instrument was made with fenestra, but with a straight edge of contact with the smaller blade and no dentations. It was found the crook-like portion could be instantly put around the tendon just as a blunt retractor is placed in tissues, the instrument closed, and the slippery tendon then held firmly while the sutures were inserted (Fig. 4). This instrument was most satisfactory, but with a desire to have as small an instrument as possible, especially such as is sometimes required in the palm of a flexed hand, the hæmostat type was discarded for the final type shown (Fig. 5), made of clock spring with a slide lock but with the same fenestrated blunt retractor-like end. This has been entirely satisfactory.

The writer has found three sets, of two each of these, useful for tendons of the hand, varying in sizes of two, four, or six millimeters in diameter. The retractor-like blade is 10 millimeters wide and the fenestra are 2 millimeters wide to allow the easy, oblique passage of a straight cambric needle. The whole instrument is about 10 centimeters long.

### NEW TECHNIQUE IN APPLYING SUTURES

With the new instrument it was found possible to work out a *new technique* whereby a more perfect application of the fine silk approximation of stay sutures might be put in, leaving a ***minimum of silk exposed*** to prevent

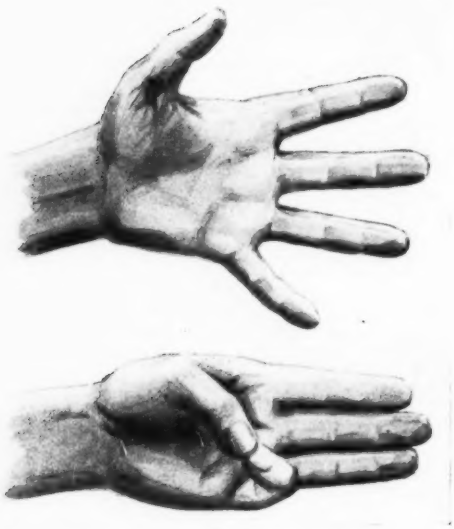

Fig. 15 (above). Patient unable to flex the adductors of the thumb before operation.
Fig. 16. Same patient after the Cook operation.

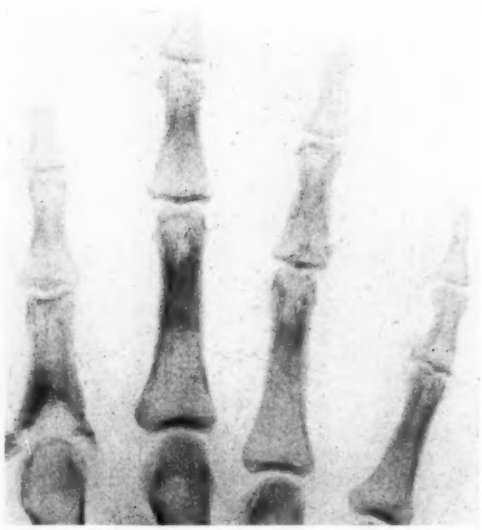

Fig. 17. Roentgenogram of patient with severed flexor tendons of the index finger and partial destruction of the metacarpophalangeal joint.

the production of possible *traumatic adhesion* from the silk.

This method consists of threading a fine straight cambric needle on each end of fine intestinal silk of suitable length. With the tendon clamp applied as close to the end of the cleanly severed end of the tendon as possible, the first needle transfixes the tendon just beyond the clamp straight through and it immediately transfixes the tendon obliquely, coming out of the first fenestrum on the *near side;* then it immediately transfixes the tendon obliquely coming out the second fenestrum of the *far side*, and finally transfixes the tendon obliquely, coming out the free end of the tendon when the first needle is removed. Now, with the second needle the same sort of procedure is carried out, only in the reverse direction, coming out obliquely in the first fenestrum on the *far side*, then the second on the *near side*, and, finally, the opposite side of the free end of the tendon (Figures 6, 7, and 8). Thus it will be seen that there remains none of the silk exposed on the side of the tendon, except small dots. When a similar arrangement of sutures is placed in the other tendon, the four silk strands may be tied closely, approximating the severed ends end-to-end by double surgeon's knots and the excess of silk cut away, so that these knots are entirely buried between the cut ends of the tendons (Figure 9).

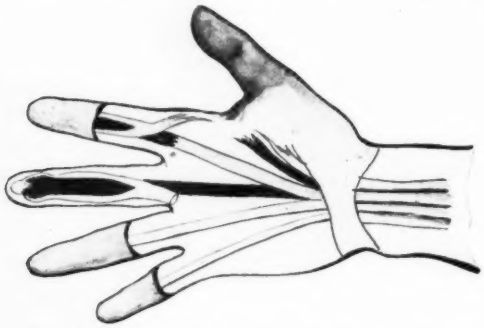

Fig. 18. Diagrammatic representation of the condition shown in Fig. 17 and transferring the sublimis tendon of the third finger to the profundus of the index finger.

PROTECTION OF POINT OF UNION BY FAT

Small sheets of fascia and fat should be dissected from the subcutaneous tissues adjacent and wrapped around the point of

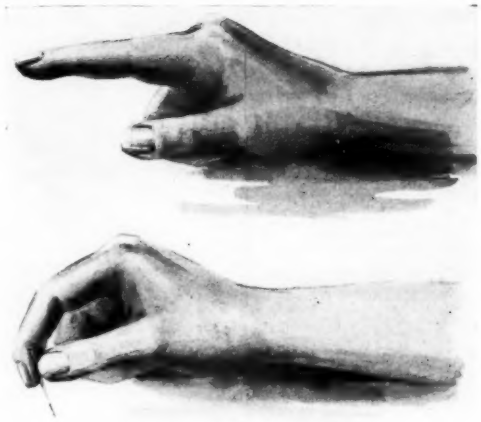

Fig. 19 (above). Condition of this patient before operation.

Fig. 20. The power of picking up small objects after operation.

union in order to prevent further adhesion, so far as possible.

Figures 10 and 11 show the application of the new tendon clamps in operative tendon transplantation of the flexor sublimis digitorum from the middle finger to the flexor profundus digitorum of the index finger. The crescentic flap is shown as is also the moist cotton to prevent drying during the operative technique and the application and tying of sutures.

### REVIEW OF TENDINOUS ARRANGEMENT IN THE HAND

It will be recalled that on the palmar aspect each finger has two flexor tendons, a superficial and a deep. Of these, the superficial is chiefly concerned in flexing the first phalanx at the metacarpophalangeal joint on the corresponding metacarpal bone, while the deep flexor has for its chief function not only the flexion of the first phalanx on the corresponding metacarpal bone, but the phalanges on each other. Therefore, if we are to depend on one only, the deep flexor alone will give us more function than the superficial flexor alone and if in the palm of the hand both flexors have been severed or bound down in scar tissue, we will naturally attach a transplanted tendon to the distal end of the remaining stump of the injured profundus. Further,

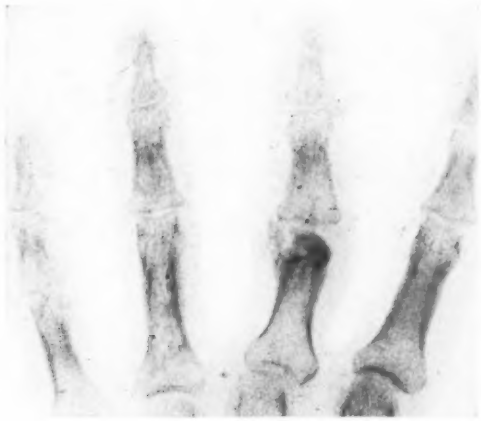

Fig. 21. Roentgenogram of patient showing destruction of first interphalangeal joint of the third finger.

in choosing a tendon to transplant and take the place of the one destroyed, we will naturally select or steal the sublimis, as we will thereby interfere to a less degree with the remaining function of the finger from which the theft is made, than if we had stolen the profundus. Figure 12 shows the sublimis tendons cut away proximally and distally in the palm to expose the underlying profundus tendons.

Passing now to the dorsal aspect, we find the thumb, index, and little fingers supplied

Fig. 22. Diagrammatic representation of the destruction of the profundus tendons in both the third and the fourth fingers, also the destruction of the sublimis in the fourth, being the condition accompanying the joint destruction shown in Figure 21. There is also shown the transferring of the sublimis of the second to the profundus of the third and the sublimis tendon of the third to the profundus tendon of the fourth.

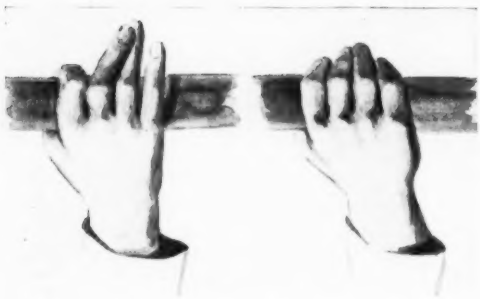

Fig. 23. At left, condition of this patient before operation, unable to grasp objects. At right, the grasp restored after operation.

with more than one extensor tendon, so that with care in selection to accomplish greater efficiency in general manual function, a tendon from one of these may be stolen (Fig. 13).

It will be found also in making a transplantation from the palmar surface to the dorsum for paralysis or other loss of extensor function, it is better to make the transplantation to one tendon, rather than suture to a group, for the reason that the application of force in one direction will yield greater precision, than if it is split up in several directions. For example, suture to all the extensor tendons of the fingers, is not as satisfactory as suture to the extensor of the middle finger for simple wrist drop. If, however, the wrist drop occurs chiefly to the ulnar side from underaction of the extensor carpi radialis longior, it would be more efficient and more correct mechanically to make our transplant to one of the extensors of the index finger or the thumb, etc.

Further, in the experience of the writer, it is necessary to attach our tendons *under* tension, to allow for stretching, to hold the part in rather *extreme overcorrection* when sutured, whether our transplant is attached to bone, periosteum or tendon to tendon, but Mayer[1] and some others dissent from this view and hold that the natural tonicity of the muscles will provide for this. When, however, we consider possible changes in the articulations and bones according to Wolff's law in deformity, another justification is found for

[1] Biesalski and Mayer. Die physiologische Sehnenverpflanzung Berlin: 1916.

Fig. 24. Roentgenogram shows the patient with destruction and non-union of third metacarpal.

Fig. 25. Roentgenogram shows sliding bone-graft obtained from distal segment to restore bone continuity.

overcorrection entirely to correct deformity, as frequently in deformities we are not dealing with soft parts alone, but bones as well.

APPLICATION

CASE 1. A strong, vigorous girl otherwise, had had frequent recurrent attacks of backward dislocation of the right thumb at the metacarpophalangeal joint from underaction or elongation of the flexor longus pollicis. This recurrence had persisted for about two years and with each attack, which upon application for treatment was of daily occurrence and followed by pain and aching up the arm. It was a painful manifestation of what is usually called a "double-jointed stunt" in boys and a source of gratification to the performer and envy to his playmates. This patient, however, had the condition only in the thumb and it was a source of extreme discomfort to her, interfering with her daily ordinary and routine pursuits and piano lessons. It was not possible to trace any given traumatism in endeavoring to establish its etiology. Being the right thumb added to her difficulties, as she was normally right handed and called upon to use it more than the left. Months of so-called conservative treatment with adhesive strapping, leather appliances with elastic bands to permit flexion from 30° to full flexion but to prevent any extension whatever, failed to afford a shortening up of the flexors to prevent recurrence and relief. An elliptical incision was made so that the flexor longus pollicis came to lie under the center of the flap and in the transverse plane of the metacarpophalangeal joint of the right thumb; the tendon sheath and radial bursa were opened and the tendon grasped by the tendon holders placed half an inch apart. To prevent drying out, bits of absorbent cotton moistened with salt solution were placed beside the exposed area. The intervening tendon was then cut transversely across with a sharp scalpel at the adjacent margin of each tendon clamp, thereby shortening the tendon by half an inch. Buried sutures were inserted in the manner above described and by flexing the thumb close, approximation end-to-end with buried knots was obtained, when the sutures were tied. A small sheet of fat and fascia was dissected free from the inside of the skin flap and placed around the point of union. The edges of the sheath of radial bursa were restored to their proper position, but not sutured. The skin was sutured with fine interrupted silk sutures. Silver foil and tissue paper covered the incision and a gauze handkerchief was placed under the thumb and in the palm, and over suitable dressing, adhesive plaster and a snug plaster-of-Paris bandage held the thumb flexed. On the eighth day the skin sutures were removed, as the skin wound was found entirely healed and the dressings re-applied to hold the thumb in the flexed position, which was maintained for 4 weeks, when after a brief course of massage and resistive exercises in flexion, full function was established and no recurrence of the disability has returned.

Fig. 26. Roentgenogram shows non-union of third metacarpal.

Fig. 27. Autogenous bone-graft obtained from the tibia shown.

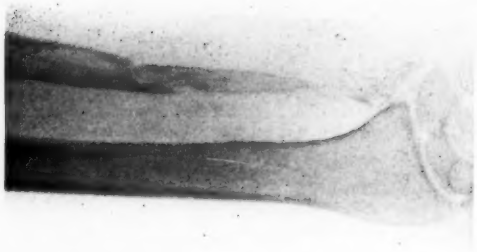

Fig. 28. Roentgenogram showing destruction of portion of radius and soft parts, with bone graft (tibia) *in situ*.

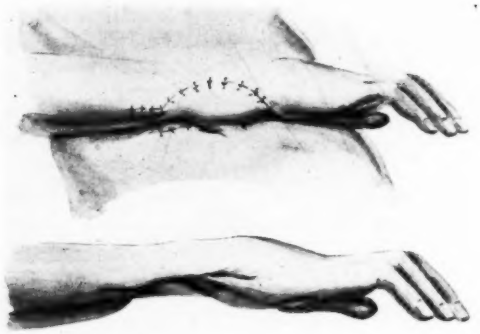

Fig. 29 (above). Skin flap obtained from abdomen (whole thickness).
Fig. 30. Arm prior to skin grafting.

CASE 2. A soldier, who had been shot through the left hand in the cleft between the thumb and the index finger, was operated on by Robert J. Cook, of my service, by the very ingenious method devised by him, as this man could not produce the opponens power in the thumb, which was held in extreme extension and abduction. Doctor Cook utilized the extensor minimi digiti, which he freed at the first phalanx of the fifth finger through a small incision and through a second incision above the styloid process of the ulna on the dorsum of the wrist located this tendon, drew it out of its sheath, passed it through the subcutaneous fat around to the palmar side to an anterolateral incision on the distal end of the metacarpal bone of the thumb, through which he passed the tendon and sutured it to itself under tension as shown in the diagram, while the thumb was held in the opponens position. The three incisions were closed and the fixation and after-treatment were similar to that used in Case 1. The man made an uninterrupted recovery of function, as shown in Figures 14, 15, and 16.

CASE 3. A soldier had been shot through the right index finger at the proximal end of the first phalanx, as shown in the X-ray and at the same time both flexor tendons were severed and their proximal ends were bound down by scar tissue in the thenal space, but the stump of the profundus at the first phalanx was identified and freed. After rounding off the jagged end of the phalanx and interposing free fat and fascia in the joint, the sublimis tendon of the middle finger was sutured end-to-end with the profundus distally. This case had complete restoration of flexor function so minute as to permit picking up a pin, as shown in Fig. 20.

CASE 4. A soldier had been hit by a piece of shrapnel in the palm of the right hand, severing the profundus tendon of the middle finger, both flexors of the ring finger and also shattering the first interphalangeal joint of the middle finger, so that this patient could not make a fist nor grasp a rod. The articulation was restored as in the preceding case and the sublimis tendon of the index finger given to the profundus of the middle finger and the sublimis of the middle finger given to the profundus of the ring finger (Figs. 21 and 22).

As a result of these procedures, this patient was restored as shown in Figure 23: *a*, before operation; and *b*, after operation.

CASE 5. Patient was shot through the palm of the hand, the tendons escaping, but the middle third of the third metacarpal was shot away and union had not occurred and the hand was very weak (Figs. 24 and 25). Sufficient bone was left in the distal fragment to permit securing of a *sliding bone-graft*, which was done with satisfactory results.

CASE 6. This patient was shot also through the palm of the hand at the junction of the middle and distal third metacarpal bone without much loss of substance but with no tendency to union and with much loss of power in the grasp. The tendons were not affected except so far as the mechanics of the hand lessened their efficiency (Figs. 26 and 27). A small bit of bone was removed from the tibia and an *autogenous inlay and spike-graft* was put in the proximal and distal fragments respectively, with union and restoration of power and function.

CASE 7. A girl, 7 years old, was sent to the corner store in mid-winter to get a can of gasoline. On her way home, she stumped her toe and spattered a large quantity of gasoline over her dress. On reaching home, she went to the kitchen range to warm herself, as she was chilled from the low temperature outside and the evaporating gasoline. Immediately her dress was in flames and she was deeply burned on the left hand, arm, left side of face and ear. On admission, dense scar formation permitted only slight movement at the axilla, elbow held flexed 110°, and the hand was a typical *main en griffe* with flexed wrist and fingers, the tips of several of the latter having sloughed off. After removing the scar, a pedicle whole thickness flap from the back restored the skin of the axilla and by means later, of a sliding flap, the elbow was restored. Finally, by means of a whole thickness skin graft, skin was obtained from the abdominal wall and a new palm and

Fig. 31. Whirlpool arm bath.

palmar surface of the wrist-joint was made leaving the pedicle attached to the abdomen two weeks. This was then cut away and the remaining sutures applied with restoration of function at the wrist-joint. Subsequently massage and a ' cock-up" splint produced a much more presentable and useful hand.

CASE 8. This patient was shot through the lower third of the radius, carrying a large part of the bone, tendons, and skin away, as is shown in Figures 28 to 30. This had to be restored in the order of skin, bone, and tendons, which was accomplished as shown in the illustrations.

The above cases represent the types most commonly met with.

### AFTER-TREATMENT

Many of these cases show marked stiffness after anatomic or functional restoration and require more or less prolonged after-care and attention to secure the maximum efficiency obtainable. Much of the success secured in these cases should be attributed to the physiotherapist as well as to the surgeon. The use of hydrotherapy in the warm or hot "whirlpool" is an excellent preparation for manipulative treatment with progressively increasing passive, active, and resistive movements either in or out of the water, and later massage and Bristow surging faradism (Fig. 31).

Much stiffness is often found in old traumatic and paralytic hands with wrist drop

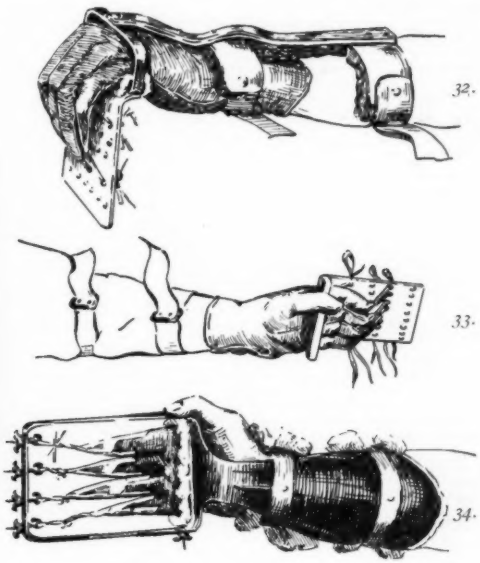


Fig. 32. Skirball's splint. Palmar application.
Fig. 33. Skirball's splint. Dorsal application.
Fig. 34. Lewis splint.

and flexed fingers and those cases showing marked tightening up of the ligaments at the metacarpophalangeal joints so that in the interim between physiotherapeutic treatments the parts may be continually stretched and recontracture prevented. This may be accomplished by suitable splints. I have found the Skirball and Lewis splints most useful.

The former was devised by Louis I. Skirball, of Boston, formerly of my service, and is made of aluminum and is very light in weight. It consists of a perforated square palmar or dorsal plate, a ring around and just below the metacarpophalangeal joint and bands at the carpus and upper forearm with straps, padded where necessary with felt. A heavy walking glove is placed on the hand with strong tapes at the distal end of each phalanx of the glove on the palmar or dorsal aspect as the case may require so that these tapes may be passed through the perforations and tied as tightly as possible to maintain the correction. The perforated plate also may be bent in any desired form in the brace shop (Figs. 32 and 33).

The Lewis splint consists of the regulation "cock-up" palmar and forearm splint plus a movable rectangular quadrangle extending 2 to 3 inches beyond the finger tips. This quadrangle is attached to the "cock-up" just proximal to the heads of the metacarpal bones and fixed at any angle of flexion that may be desired by two lateral thumb nuts. On each finger at fault is fastened surgeon's plaster adhesive traction straps terminating in tapes which are caught over hooks at the distal end of the quadrangle. Traction may be regulated by thumb nuts on the screw thread of the hooks whereby the stretching of the ligaments at the metacarpophalangeal joints may be effected (Fig. 34).

The type of case which offers the most serious difficulties to the restoration of manual dexterity is that involving the tendons at the wrist binding them down and massing them, as an extensive scar, which in all instances can not be appreciated as to extent by what appears on the surface, because the primary infection involves not only the tendon sheaths but extends subcutaneously in all directions that are anatomically possible, so as to cause adhesive agglutination of the fascial spaces and bursæ as well; added to this the fusion of the carpal bones by impaction plus an inflammatory process renders the wrist-joint and tendons immobile and ankylosed, so that little can be done to aid such cases if extensive as shown by the X-ray and unyielding under an anæsthetic and later to physiotherapy.

Finally, arthrodesis, if extensive between the radius and ulna, preventing pronation and supination, hampering the proper use of the hand, is a difficult complication to combat because by the operative chiseling away of the union and the implantation of fat and fascia or muscle, one can rarely be sure of curative results, for in spite of all we do, the bridge of bone will more often than not re-form.

In conclusion, I wish to express my thanks to Doctor J. Fletcher Lutz for the X-rays and to Misses Salome Slingluff and Anita De Goll for their painstaking drawings for this article.

# A STUDY OF CHRONIC ENDOCERVICITIS[1]

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SINCE 1862, when T. A. Emmett began his observations upon the cure of "cervical erosions," chronic endocervicitis has been the "bugbear" of all conscientious gynecologists. That there was a very annoying discharge issuing through the cervical os was a well-known fact, but the cause of this symptom no one seems to have known. Uteri were curetted; cervices were treated by all "manner of means" and still the leucorrhœa persisted.

Amputation of the cervix was known to be a curative procedure in a certain proportion of these cases, but the operation, often incompletely performed, left a cervical stump, which, in the child-bearing period of life, gave trouble and in many instances did not cause the discharge to disappear. Therefore, this procedure was not universally looked upon with favor when performed for so simple a complaint as leucorrhœa.

Coming to our present day conception of chronic endocervicitis, we now know, mainly through the work of Sturmdorf, of New York, and Curtis, of Chicago, that the primary cause of this annoying symptom, cervical leucorrhœa, is infection of the cervical mucosa, which, sooner or later, involves the deeper structures, producing a cervicitis, and we believe, furthermore, may even cause a parametritis, salpingitis, ovaritis, etc., and that the only successful way to stop the discharge is by the eradication of the infected focus.

In both structure and function the cervical mucosa differs widely from the endometrium of the corpus uteri. The cervical canal, lined with its mucosa, acts simply as a passive communicating channel between the vagina,

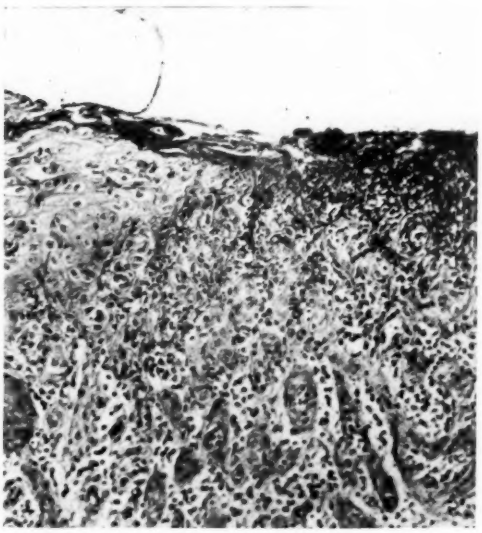

Fig. 1 Microphotograph of section (high power) through *a*, Fig. 5, showing granulation tissue, erosion, new formation of gland tissue, and marked chronic inflammation as shown by marked round-cell infiltration, engorged blood vessels, and lymph spaces with resultant fibrous tissue formation.

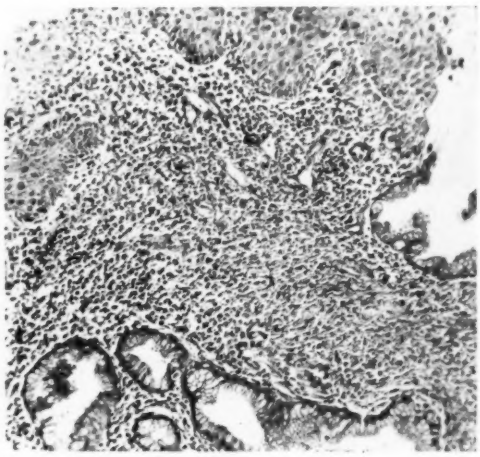

Fig. 2. Microphotograph of section (high power), 1 centimeter above section in Figure 1, showing glandular erosion, cystic formation from plugging duct of gland with marked round-cell infiltration, deposition of fibrous tissue, etc. (chronic inflammation.)

[1]From the Department of Obstetrics and Gynecology of the Long Island College Hospital. Read before the Brooklyn Gynecological Society.

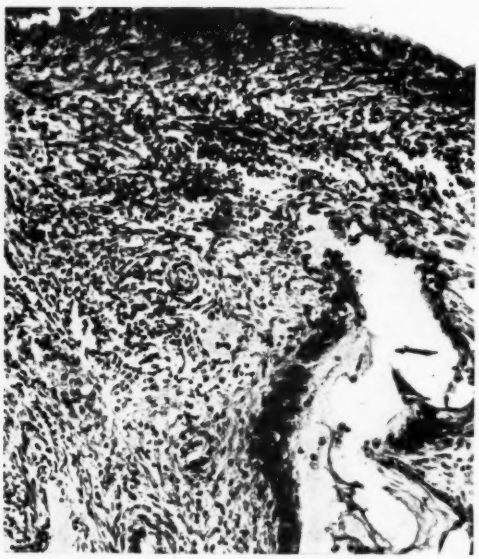

Fig. 3. Microphotograph of section (high power) at *b*, Fig. 5 showing marked chronic inflammation with large dilated gland beginning Nabothian cyst in lower right field.

Fig. 4. Microphotograph of section (high power) at *c*, Fig. 5, just inside the internal os, showing very few chronic inflammatory changes.

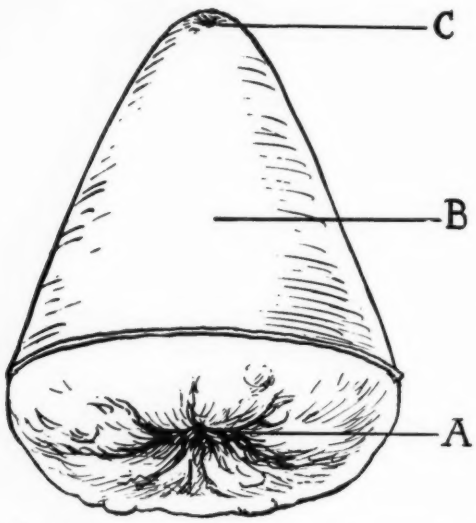


Fig. 5. *a*, External os; *b*, internal os. Sections at *a*, show marked chronic endocervicitis with cystic formation; at *b*, the same condition, but to a lesser degree, while at *c*, if the "cone incision" has gone beyond the focus of infection, there should be no signs of a chronic inflammation.

which is always the habitat of many and various bacteria, and the uterine cavity, while the corporeal endometrium is constantly passing through the active changes which are essential to menstruation and deciduation. The cervical mucosa, composed largely of deep penetrating racemose glands, evinces a marked susceptibility to infection, while, according to Curtis, the corporeal endometrium is practically immune.

Therefore, endocervicitis should be a very common disease, and endometritis, as a pathological entity, should rarely be met with.

Inflammation of the intracervical mucosa may be acute or chronic and may occur either as a primary or secondary infection; primary when the infecting agent directly invades the cervical mucosa and secondary when the infection extends upward from the vagina or downward through the uterus.

The organisms most commonly found are the gonococcus, staphylococcus, streptococcus and colon bacillus, the gonococcus and staphylococcus being by far the most prevalent.

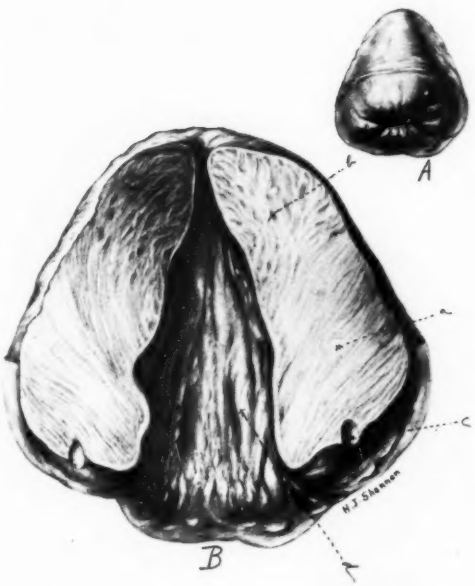


Fig. 6. *a*, Excised cone of cervix; *b*, cone laid open. Cervical cone—comparable in size to normal-sized uterus, shows enormous size that cervix may attain through hypertrophy, caused by chronic low-grade inflammation extending over many years. At *a*, notice how completely that fibrous tissue has replaced muscle tissue; at *b*, notice that only a small portion of muscle tissue remains; at *c*, Nabothian cysts; at *d*, infected mucous membrane enormously thickened.

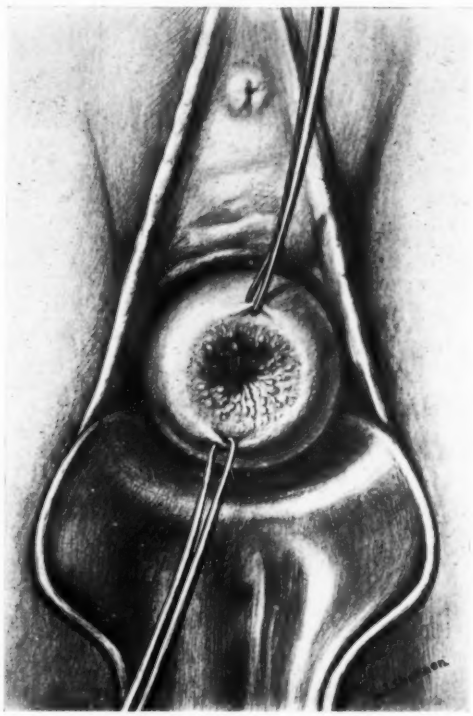

Fig. 7. Cervix exposed. Tenacula in place demonstrating area to be excised.

Trauma, *e.g.*, lacerations during childbirth, dilatation, curettage, cauterization, the constant irritation of a stem pessary, opens up avenues for infection and are thus predisposing factors in the production of chronic endocervicitis.

But, remember! trauma is only a contributory cause, for, as Sturmdorf so aptly states, "The dominating pathologic factor that determines the morbidity of a cervical laceration is not the extent of the tear, but the incidence of its infection. Such an infection does not remain limited to the lacerated area, but sooner or later involves the entire endocervical mucosa from the external to the internal os."

In children vulvovaginitis from any cause, the exanthemata, especially diphtheria and scarlet fever, and the general debilitating diseases often produce a marked susceptibility to cervical infections.

Acute endocervicitis and cervicitis occur in the course of acute gonorrhœal and puerperal infections of the uterus, but are seldom recognized at this time as definite pathological entities.

The mucosa of the cervix when chronically infected is swollen and often everted, while the mucosa of the portio about the external os presents a circumscribed area of glandular proliferation. The columnar epithelium covering the mucosa of the cervical canal, under the constant stimulation of infection, actually pushes itself out on to the vaginal aspect of the cervical rim, replacing the stratified epithelium which is normally present in this situation, thus producing the so-called *erosion*. This erosion, or "red area," about the external os, therefore, is not

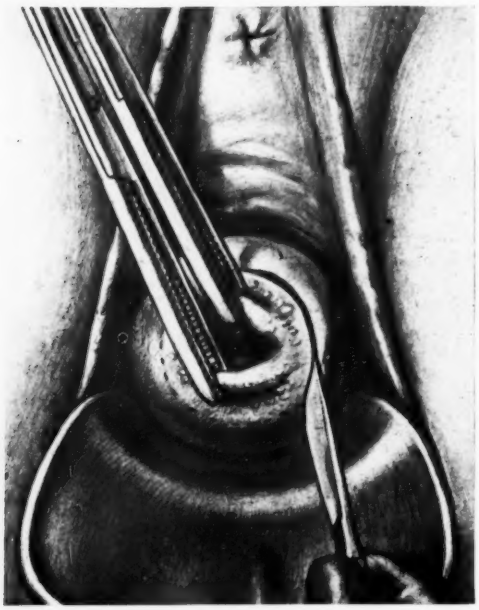

Fig. 8. Outlining with knife external limits of erosion to be excised.

Fig. 9. Pushing back mucous membrane with handle of knife, following the natural line of cleavage. No bleeding.

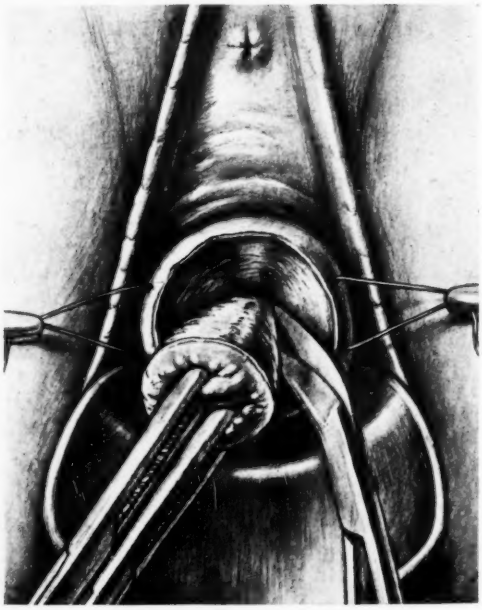

Fig. 10. Extending the "cone incision" using very sharp-pointed, curved-on-the-flat scissors. A long narrow scalpel may be used.

an ulceration in any sense of the word, but is a new formation of gland tissue and may, under certain conditions, become malignant. The continued congestion incident to such a condition produces a hypersecretion of mucus from the gland structures and ultimately a hyperplasia and hypertrophy of the cervical connective tissue. Sooner or later the crypts of these glands become occluded with consequent cyst formation—the so-called Nabothian cysts so familiar in this region of the cervix.

This cyst formation may take place partly by the hyperplasia of the periglandular connective tissue encroaching upon the lumen of the glands and partly by the overproduction of thick viscid mucus plugging the outlet ducts or during the process of cure or even attempted healing the squamous epithelium may grow out over the erosion and actually "choke" or cover over the gland openings.

This cystic condition, as might naturally be expected, increases the bulk of the already hypertrophied cervix and thereby interferes

Fig. 11. Same as Figure 10, showing "cone incision." It may also be used for deeply lacerated cervices.

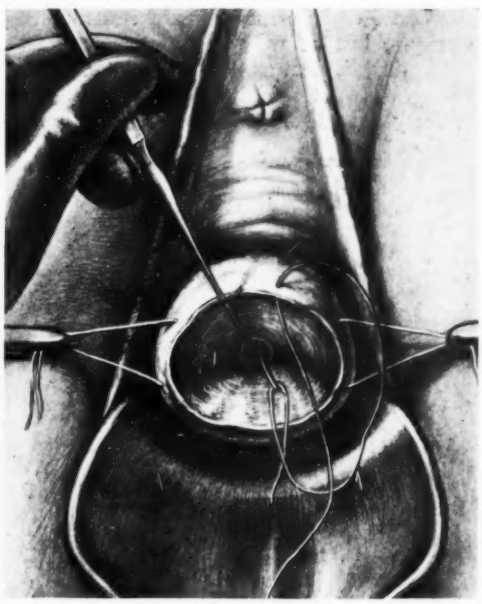

Fig. 12. Showing first half of the double inverting stitch as suggested by Sturmdorf.

with its circulation and muscular contraction. It is this hyperplasia which causes the pre- and the postmenstrual metrorrhagia so frequently met with in multiple cystic formation of the cervix.

Microscopically we may find all the evidences of a chronic inflammation, or in many instances there is very little inflammatory change in the stroma, and except for a preponderance of gland tissue, the section appears almost as normal cervical tissue. Section of a Nabothian follicle may show as a large clear space lined with columnar epithelium and filled with mucus. Surrounding this there may be the signs of an active chronic inflammation, as shown by round-cell infiltration, œdema, congestion, dilated lymph spaces, etc. In the musculature nearest the cervical mucosa, there may be found small inflammatory foci or even small multiple abscess formations.

Sections from the excised cones (Figs. 5 and 6) show erosions, chronic inflammation, cystic changes, etc., as described in varying degrees of intensity. Beginning at

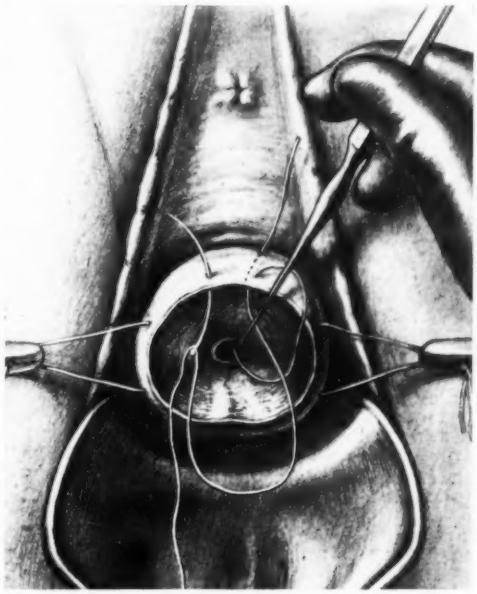

Fig. 13. Showing second half of the double inverting stitch as suggested by Sturmdorf.

the distal end we find marked inflammatory changes, but as we approach the proximal extremity, i.e., near the internal os, these changes are either barely perceptible or are entirely absent, showing the efficiency of the procedure to be described in so far as the removal of the infected area is concerned (Figs. 1, 2, 3, and 4).

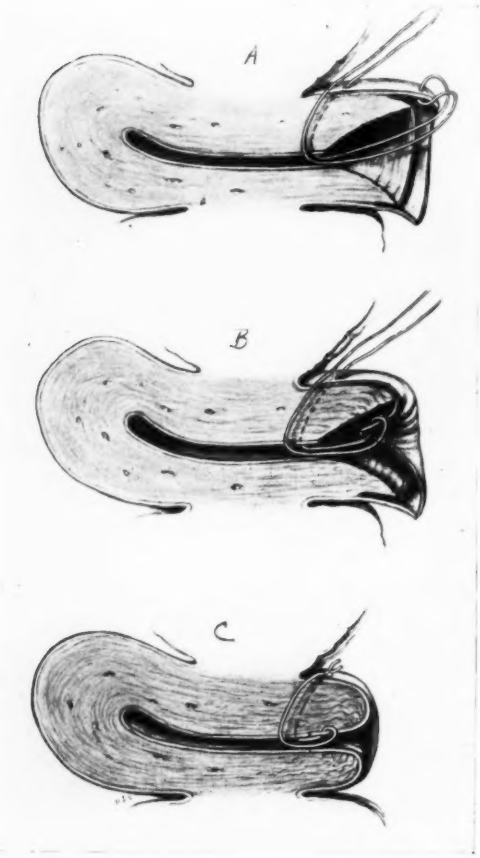


Fig. 14. Longitudinal section of the cervix and uterus showing the inversion of the cervical reflection of the vaginal mucous membrane. *a*, Stitch placed; *b*, traction on sutures with partial inversion of mucous membrane; *c*, more traction on suture with complete inversion of mucous membrane.

The clinical course of chronic endocervicitis is slow and insidious and shows little or no tendency toward a spontaneous cure.

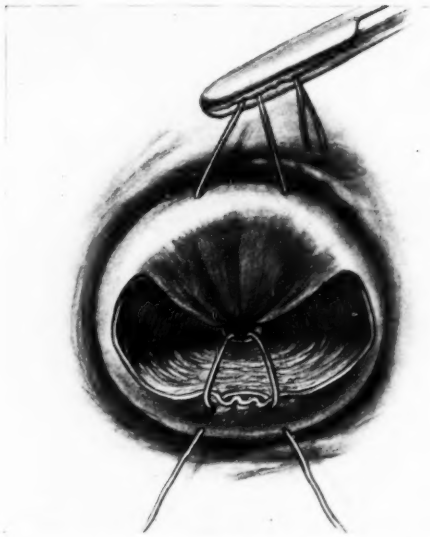

Fig. 15. Sutures placed. Inversion by traction completed for anterior flap. Note position of suture in posterior flap—not yet drawn up.

The symptoms are variable. In the milder cases, where the infection is not sufficiently virulent to be progressive, cervical leucorrhœa of a mucoid character, which may be scanty or profuse, is the only symptom complained of—very simple to describe, but often extremely invidious to the patient and well nigh invincible to the physician. When the infection extends to the deeper structures

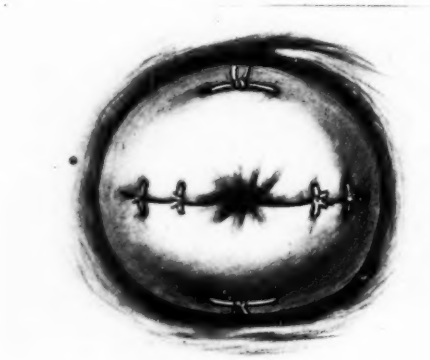

Fig. 16. Operation completed. Note only 6 sutures are required.

of the cervix and the uterus, giving rise to an ascending lymphangitis, which, we believe, may extend into the parametrium up through the lymphatics to the fallopian tube, producing a perisalpingitis or endosalpingitis, peritonitis, and ovaritis, the symptoms are those of a chronic pelvic inflammation accompanied by a profuse mucoid or mucopurulent cervical discharge. Under such circumstances the subinvolution which the circulatory and lymphatic stasis causes, renders these structures more susceptible to new infection and less resistant to the old infection.

Chronic endocervicitis is always attended by some degree of posterior cellulitis in the uterosacral ligaments, which explains the premenstrual and the comenstrual backache and dyspareunia so frequently complained of. The prominent symptom in most cases is leucorrhœa. This discharge is intermenstrual, is mucoid in character, usually profuse and viscid, translucent or opaque, or curdy, or it may be purulent when the inflammation is suppurative. It is always more abundant just before and after the menstrual period. The patient often suffers from metrorrhagia and menorrhagia, resulting from the circulatory stasis and the intermuscular lymphangitis which has impaired the contractile power of the uterine muscle. The lumbosacral pain is due to the traction of the cervix on the thickened, tender, uterosacral ligaments. Many patients complain of no symptoms, though examination will always reveal the erosion, the cystic hyperplasia, and the presence of a cervical discharge.

Sterility in women with apparently normal cervices, which may or may not be anteflexed, is, in the vast majority of cases, due to the existence of a chronic endocervicitis, dating either from childhood or from an infection soon after marriage. Such an infection need not be gonorrhœal, for we know that staphylococci from the husband's prostate gland are sufficiently virulent to infect the cervical mucosa of his wife, even though his last debauch was 20 years previous to his marriage.

Reynolds, of Boston, has demonstrated that a spermatozoon, no matter how vigorous, cannot long withstand the strain of progress through the thick, tenacious mucus that plugs the canal of a diseased cervix.

Furthermore, the cervical infection following lacerations of the cervix in those women who have borne one child, but have subsequently remained barren, must be recognized as a very important factor in the production of their continued sterility.

The prognosis in chronic endocervicitis is doubtful. When the infection is slight and the coincident inflammation mild and treatment is instituted early, complete recovery may take place. On the other hand, when the infection is virulent and the inflammatory changes are marked, many possibilities loom in the field. The cervical glands may harbor infecting organisms for years. These glands are situated in tissue that is more or less richly supplied with lymphatic drainage. These lymphatic channels pour their contents into lymph channels which communicate with the lymphatic chains in the parametrial tissues and in the uterosacral ligaments. Hence the associated lesions as metritis, parametritis, and uterosacral cellulitis, are progressive and not until the focal infection is cured can these associated lesions, which produce the symptoms of leucorrhœa, menorrhagia, metrorrhagia, and lumbosacral backache, be improved. Furthermore, long-continued cervical inflammation may be considered a prodrome of cervical cancer, for it is but a step from the extreme cell proliferation with an orderly arrangement that occurs in hyperplastic endocervicitis to the disorderly arrangement of embryonal cells found in cancer.

The treatment of chronic endocervicitis is palliative or operative—usually operative.

The palliative treatment, local and systemic, is well known. I wish to state, however that, after giving all of the local methods for the cure of chronic endocervicitis a fair trial, we have come to the conclusion that, aside from the treatment of simple erosions of limited area which have not become infected, palliative measures do not cure chronic endocervicitis. This will become evident when you recall the pathology of the condition, which is infection,—tissue reaction,

cell proliferation—increased gland activity, and hyperplasia. How can local palliative treatment alter such a pathological condition?

Furthermore, how can the curette effect a cure in such a condition. By curettage we do not remove all the gland tissue of the cervical mucosa, and wherever the gland tissue remains undisturbed, the infection remains unmolested. The infecting organisms inhabit the most remote branches of the deepest racemose glands in the cervical mucosa and, therefore, the futility of eradicating all infective foci by the use of the curette is at once apparent. It cannot possibly be done.

Sturmdorf, in his very excellent work, has called attention to the pathology resulting from chronic endocervicitis and has suggested excision of the infected area by a method which preserves a greater part of the cervical musculature (Figs. 5 and 6).

During the past 3 years, at the Long Island College Hospital, we have treated all cases of extensive chronic endocervicitis with the associated tissue hyperplasia by the surgical method of Sturmdorf. The technique of this procedure with certain modifications, which we believe are advantageous, is as follows:

With the patient anæsthetized and placed in the lithotomy position, and the vulva, vagina, and cervix prepared for operation, the anterior and posterior lips of the cervix within the margin of the erosion are grasped with Jacob's forceps and the cervix pulled down (Fig. 7). An incision is then made through the mucous membrane of the portio, encircling the limits of eroded area (Fig. 8).

The portical mucosa is pushed back for a distance of 3 or 4 centimeters or more, if necessary, to acquire sufficient flap of mucous membrane completely to cover over the excised area of cervical tissue (Fig. 9). Then, with a sharp-pointed pair of Emmett's scissors, while traction is being made on the cervix by the Jacob's forceps previously placed, the entire glandular area surrounding the cervical canal is "coned out," the "cone-incision" extending up to or just below the internal os (Fig. 10). Great care should be exercised in preserving all the muscle tissue possible and still remove all the infected area. If too much cervical tissue is removed, the operation becomes a high amputation, which, for obvious reasons, should be avoided (Fig. 11). If, on the other hand, not enough tissue is removed and infected glands are left behind, the purpose of the whole operation is defeated. Before removing the conical plug, which is now attached only by a small rim of cervical tissue and cervical mucosa, two sutures of No. 2 chromic catgut on a cervix needle are placed through the previously liberated flap of vaginal mucous membrane to either side of the partially-excised cone, including a good bite of cervical tissue. When these sutures are drawn taut, the operative field is brought well down toward the vulva. The cervical canal, at the uppermost limit of the cone, is now opened and a single tenaculum is introduced into the canal for the purpose of further bringing the cervical stump down nearer the vulva. When this is done, the remainder of the cone is excised.

The vaginal flap originally liberated at the beginning of the operation, is now inverted into the hollowed-out shell of the cervix by the double inverting stitch of Sturmdorf (Fig. 12). This manœuvre brings the vaginal mucosa into contact with the cervical mucosa and this completely covers all the denuded areas and, furthermore, substitutes healthy vaginal mucosa for infected cervical mucosa. This stitch is of silkworm gut and when tied, not only coapts the vaginal mucosa to the cervical mucosa, but controls bleeding from the tissues through which it passes (Fig. 13.) This suture is left *in situ* for 3 or 4 weeks, or until the patient returns for her follow-up examination after discharge from the hospital (Fig. 14). The chromic gut sutures to either side, which have thus far acted as traction sutures, are now tied (Fig. 15), bringing the gaping outer angles of the "coned incision" together and completely controlling hæmorrhage (Fig 16). With all sutures tied, six in number, the operation is complete and a small strip of iodoform gauze drain is placed against the cervical stump, which is removed in 24 hours.

I have collected from our records at the Long Island College Hospital 200 cases

in which from 6 months to 3 years have elapsed since operation, with the results as shown below. Cases of marked chronic endocervicitis with and without lacerations:

| | |
|---|---|
| Cured | 128, or 64 per cent |
| Improved | 56, or 28 per cent |
| Unimproved | 16, or 8 per cent |

These results compare very favorably with Leonard's report of amputation of the cervix in 109 cases with marked leucorrhœa from Dr. Howard A. Kelly's clinic at the Johns Hopkins Hospital in which 62.5 per cent were cured, 30 per cent were improved, and 7.3 per cent were not improved. But it should be remembered that the operation above described is not an amputation of the cervix in any sense of the word and the various complications that may arise especially in the child-bearing woman from amputation of the cervix are very materially lessened or entirely avoided in the operation of excision of the cervical mucosa. We have not delivered a sufficient number of these women upon whom excision of the cervical mucosa has been performed, to draw any definite publishable conclusion, but so far, in a limited number of cases, we are of the opinion that a cervix upon which the "cone operation" has been done will cause but little, if any, more trouble during pregnancy and labor than one upon which trachelorrhaphy has been performed.

### CONCLUSIONS

From this study the following conclusions may be drawn:

1. That chronic endocervicitis is a very common and intractable disease which has far greater possibilities in the production of pelvic disease than has heretofore been supposed.
2. That in the vast majority of cases the only hope of a cure is the complete removal of the infected focus.
3. That while the surgical method herein recommended is not a perfect one, we believe that, when properly done, it is, at the present time, the best method we possess for the eradication of the infected area.

I take this opportunity to acknowledge my indebtedness to Dr. John Osborn Polak for placing at my disposal the material which made it possible to carry on this work, and to Dr. Arnold Sturmdorf, of New York, for his many valuable suggestions.

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# EPICONDYLITIS HUMERI

By LOUIS CARP, M.D., New York
Instructor in Surgery, College of Physicians and Surgeons, Columbia University

On numerous occasions I have encountered a condition in individuals engaged in heavy manual work, characterized by pain in the elbow region and functional impairment to a greater or lesser degree, together with persistent tenderness limited to the epicondyle of the humerus, and I have sought some confirmation of this clinical picture in the literature extant. While this condition has not been dignified as an entity in the current textbooks of surgery in the English language, I do, however, find some very pertinent references to it in a discussion which was participated in by several German authors in 1910.

The following case will illustrate the condition quite clearly:

M. S., age, 60; peddler; Russian; married; remembered no previous illness except influenza 3 years ago. When first seen in my surgical service at the Good Samaritan Dispensary, he complained of pain and tenderness in the right elbow region, weakness of the forearm, and difficulty in lifting with his right hand. These symptoms came on suddenly 6 weeks previously, and he attributed his condition to his occupation; he believed that in the act of throwing into the air toy balloons he had strained his arm.

There was nothing in the general physical condition that had any bearing on the local findings. His right elbow presented no external signs of inflammation. Pressure over the external epicondyle

elicited exquisite tenderness. Flexion and extension of the elbow caused pain. The hand grip was weaker than on the opposite side, and lifting with the right hand in supination was possible with difficulty but almost impossible with the hand in pronation. There was no atrophy of the muscles of the forearm or arm. The urine and blood Wassermann were negative. X-ray examination showed a prominent external epicondyle, but the picture of the opposite side revealed the same condition. There was no endosteal nor periosteal change. The progress of the case therapeutically over a period of 2 months was not successful. Immobilization in semiflexion, massage, and the internal administration of salicylates produced but little improvement.

Two other cases, one in a presser of clothing and the other in a piano polisher, the latter from the surgical dispensary of the Presbyterian Hospital, were analogues of the above case. In the latter case the symptoms were present for one year with periods of intermission and remission.

In a series of cases reported by Vulliet, Franke, Bernhardt, Momburg, and Dubs, the average duration of the condition is about 6 weeks. The symptoms disappeared either gradually or sometimes over night, with only a persistence of the tenderness over the epicondyle. During the course of the disease, there may be free intervals of several days with recurrence. The etiology is a doubtful point. Momburg laid stress on the disease being postinfluenzal and thinks that trauma and strain are open for discussion. Bernhardt is inclined to call it an occupational neuralgia and thinks that strain is a distinct etiology. Franke believes in strain, and in one case he exsected the epicondyle. Dubs, in an experience with 9 cases, comes to the conclusion that tennis elbow and Vulliet-Franke epicondylitis are identical. He believes that the trouble lies in the capsule of the elbow-joint rather than the epicondyle, because of negative X-ray findings.

With extended experience, I would not have the impression prevail that this train of symptoms need be limited to the epicondyle. Of late, I believe I have seen similar involvement of the styloid process of the radius and the condyle of the femur, all in individuals who subjected these parts to severe muscular effort. Franke, in his original article, also emphasized affection of these anatomical processes. In all my cases, however, the tenderness was not so marked as in the epicondylitis humeri, and there were slight diffuse swelling and redness, never encountered in epicondylitis humeri.

## CONCLUSION

The nomenclature, epicondylitis humeri, has been adopted for the title from Franke's original article. It is a definite syndrome, the etiology of which is in dispute, and, I think, once seen can usually be diagnosticated. Immobilization seems to be the best treatment. Its course seems to be self-limited and may be rather protracted, notwithstanding additional therapy.

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# ABSCESS OF THE PROSTATE[1]

By HERMAN L. KRETSCHMER, M.D., F.A.C.S., Chicago
Urologist, Presbyterian Hospital; Genito-Urinary Surgeon, Alexian Brothers Hospital; Assistant Surgeon, Children's Memorial Hospital; Assistant Professor Surgery, Rush Medical College

THIS paper is based upon a series of 43 cases that were seen in hospital, consultation, and private practice.

Abscess of the prostate is generally looked upon as a complication of gonorrhœa. Most textbooks on genito-urinary surgery consider it as a complication, and in a discussion of this subject one finds it described under the heading of complications of gonorrhœa.

There are cases of abscess of the prostate, however, which are not complications of gonorrhœa. It is a well-known fact that abscess of the prostate may occur as a complication of some of the acute infectious diseases, such as typhoid fever, mumps, and influenza. This fact has again been called to our attention by Bugbee, who in a recent paper was able to report 5 cases of abscess of the prostate that were seen as complications of cases of influenza that occurred in the recent epidemic. Guiteras' case of abscess of the prostate, occurring in an attack of measles, is another example of this type of case met with in the course of one of the acute infectious diseases.

There is still another group of cases in which the abscess is metastatic in origin and in which a primary focus of suppuration can be demonstrated. It would appear, upon careful study, that this type of case occurs more frequently than is generally the opinion.

In this series of cases we had a number of instances in which an abscess of the prostate followed a focus of infection remote from the prostate. These cases seemed to be of sufficient interest to merit a detailed report and will be considered later in the paper.

For purposes of study the 43 cases have been divided into the following groups:

1. Cases complicating gonorrhœal urethritis;
2. Metastatic abscess of the prostate;
3. Abscess of prostate following trauma to urethra, *e.g.*, instrumentation;
4. Abscess of prostate associated with hypertrophy;
5. Abscess of prostate associated with strictures of urethra;
6. Abscess of prostate associated with appendicitis;
7. Abscess of prostate associated with stone;
8. Abscess of prostate in which the etiology was not determined;
9. Abscess of prostate and general sepsis.

Of these 43 cases, there was one in which the age was not stated. The decades in which abscess of the prostate occurred were:

| Years | Cases | Percentage |
|---|---|---|
| Not stated | 1 | 2.32 |
| 11 to 20 | 1 | 2.32 |
| 21 to 30 | 11 | 25.58 |
| 31 to 40 | 15 | 34.80 |
| 41 to 50 | 11 | 25.58 |
| 51 to 60 | 1 | 2.32 |
| 61 to 70 | 3 | 6.96 |

*Previous operations.* One patient had been operated upon—an external urethrotomy and an epididymotomy—many years before the abscess of the prostate developed. Another patient had had his right testicle removed because of traumatism, the abscess, which was gonorrhœal in origin, developing 4 months after the testicle operation. One patient was operated upon for rectal abscess in 1919 and also for fistula in ano, the abscess developing after the passage of sounds. Another patient had been operated upon for suppurative appendicitis and had left the hospital 12 days before he was readmitted because of complete retention of urine. In view of the fact that he had never had gonorrhœa and there was no evidence of past or present gonococcus infection at the time, it is reasonable to assume that there was some causal relation between the suppurative process in the appendix and the prostatic abscess. These cases will be considered in detail later in the paper.

*Previous illnesses.* Of this series of 43 cases of abscess of the prostate, 30 cases gave a

[1]Read at the annual meeting of the American Association of Genito Urinary Surgeons, Rochester, Minnesota, May 31, June 1 and 2, 1920.

positive history of gonorrhœal infection, either recent or remote. Thirty of these cases showed at the time of admission to the hospital the presence of an acute or chronic urethral discharge, or gave a history of a recent gonorrhœal infection. Examination of the discharge showed the presence of the gonococcus in 16 cases.

Routine blood Wassermann reactions and gonococcal complement fixation tests were not made in all the cases, this not being possible for various reasons. The Wassermann reaction was reported negative in 16 cases and positive in 3 cases. Gonoccocal complement fixation tests were made in 22 cases, and were found negative in 11 cases, positive in 11.

In the 11 cases in which the gonococcal complement fixation test was positive, gonococci were found in the urethral discharge or in the pus obtained from the abscess. In the 11 negative reactions, 7 patients showed the presence of an urethral discharge and 3 had gonococci in the discharge. Two of the remaining 5 cases were metastatic cases: one, secondary to a carbuncle; the other, to an osteomyelitis of the finger. One patient had been treated with sounds. In 1 case there was no venereal disease present. The remaining 2 cases gave a history of a chronic discharge.

*Examination of pus from the abscess.* In 18 cases gonococci were found in the pus obtained from the abscess. Staphylococci were recorded in 5 cases; streptococci in 1 case; both staphylococci and streptococci in 2 cases; and bacillus coli in 1 case. In one case the cultures remained sterile, and microscopic examination of the pus failed to show the presence of organisms. The 4 cases showing staphylococci in the prostatic pus, yielded the following data:

One patient had no evidence of gonorrhœa at the time he entered the hospital. One patient had all the symptoms and signs of active gonorrhœa, including a positive gonococcal complement fixation test. The third patient had no signs of gonorrhœa and the fourth occurred in a patient, aged 67, who had been catheterized because of retention due to hypertrophy. The 2 cases showing a combination of staphylococcus and streptococcus, were nonvenereal cases.

*Leucocyte counts.* There were 23 cases in which blood counts were made and all showed the presence of a leucocytosis. The highest leucocyte count recorded was 30,000. With the opening of the abscess surgically, or its rupture into the urethra, a prompt drop in the leucocyte count occurred. The differential leucocyte count showed the presence of an increase of the polymorphonuclears. A differential leucocyte count was not made in all the cases. In 1 case, in which this was done, the presence of an eosinophilia was found.

### METASTATIC CASES

Metastatic abscess of the prostate is a rather uncommon clinical picture, and the prostatic condition is often not recognized until late in the course of the patient's illness, being overshadowed by the primary focus until the onset of complete retention of urine or painful and difficult defæcation, at which time a rectal examination is made. Von Frisch has reported 2 cases of this type: one associated with a severe phlegmon of the forearm and the other secondary to a phlegmonous angina. Legrain has reported a case in which the primary focus was a phlegmon of the forearm in which the thumb was amputated because of necrosis of the bone of the thumb. In 1 of my cases there was a necrosis of the last phalanx of the index finger.

In 1 case in this group, the patient gave a very definite history of acute tonsillitis with chills and fever. A few days after the onset of the acute tonsillitis, the patient was seized with symptoms which were attributed to an attack of acute cystitis. Urination became more difficult and painful, and complete retention set in, necessitating the use of an indwelling catheter. A perineal operation was done elsewhere and pus evacuated. Unfortunately, complete data are not available.

A case recently reported by Randall was metastatic in origin, the primary focus being a series of boils. As examples of this type of prostatic abscess, permit me briefly to present the following cases:

CASE 1. R. U., age 48, referred by Dr. Cramps. The patient denied venereal infection.

Four weeks before admission to hospital, patient developed a felon on the index finger of his right

hand. This was opened by his physician and treated with wet dressings. A fortnight later he developed repeated attacks of chills and fever, at which time he was obliged to urinate from 10 to 12 times during the day and from 5 to 6 times at night. He also complained of pain in the region of the rectum which radiated toward the base of the bladder and was associated with the act of urination. Difficult urination began a week later and gradually increased in severity so that he developed complete retention.

*Examination.* A suppurative wound was found on the index finger of the right hand. External genitalia, negative; no discharge. Urinalysis: Specific gravity, 1,020; trace of albumin, sugar and casts, negative, few pus cells and a few red blood cells. Examination of the blood showed a leucocytosis of 28,000. Wassermann reaction and gonococcal complement fixation test were negative.

Rectal examination showed an enormous, soft, fluctuating swelling in the region of the prostate. The swelling extended beyond the reach of the finger; hence, the seminal vesicles could not be felt. The prostate was very painful upon examination.

A perineal operation was performed and the abscess drained. An abscess was found in each lobe.

Examination of the pus from his finger showed the presence of streptococci, and the pus obtained from the prostatic abscess, streptococci, staphylococci, and bacilli.

Blood cultures were made on two different occasions and each set of cultures remained *sterile*.

CASE 2. D. Y., age 43, referred by Dr. Daniel E. Murphy. Venereal infection denied.

The patient had been under treatment by his family physician for a carbuncle in the back of his neck, which had been incised and drained. Two weeks before admission to hospital, patient began to have frequency of urination to so great an extent that he was obliged to void every few minutes during the day and 4 or 5 times at night. He complained of pain associated with the act of urination, which was located chiefly in the glans penis. Increased difficulty of urination gradually developed; this caused him to strain a great deal which was accompanied with very severe pain in the rectum. The day before admission, he developed complete retention of urine which necessitated catheterization that night.

*Examination.* A partly healed wound was found in the back of his neck. Above the symphysis pubis was felt a large mass which was interpreted as being due to a distended bladder. External genitalia, negative; no discharge. Urinalysis: specific gravity 1,018 acid; albumin+, and some pus cells. Cultures showed bacillus coli.

Rectal examination revealed a large, smooth, fluctuating mass in the left half of the pelvis. This mass was as large as a peach. The seminal vesicles were not felt.

Blood examination showed a leucocytosis of 15,600. Wassermann reaction and gonococcal complement fixation test were negative.

A perineal operation was performed and the abscess drained.

Staphylococcus aureus was found in the cultures made from the pus obtained from the abscess, and in the pus obtained from the wound in his neck.

A blood culture was made, but this remained sterile.

Blood cultures were made in both these cases. In the first case blood cultures were made on different days and both sets were negative. In the second case, only one blood culture was made and this remained sterile. Both cases entered hospital long after the beginning of the abscess.

### ABSCESS OF THE PROSTATE FOLLOWING INSTRUMENTATION

Prostatitis and epididymitis may be noted very often after the rough and careless passage of sounds, metal catheters, cystoscopes, etc. These complications may occur in venereal as well as in nonvenereal cases. Abscess of the prostate following urethral instrumentation is not seen so frequently as the previously mentioned complications. It may be possible that some of the cases developing severe local symptoms after urethral instrumentation are in reality cases of abscess which are many times overlooked, or that they progress up to a certain point, undergo resolution, and for this reason are not recognized.

In several of the gonorrhœal cases the patients' symptoms developed soon after the passage of metal instruments by the local physicians, who disregarded the fact that a profuse gonorrhœal discharge was present at the time. There can hardly be any doubt between cause and effect in cases in which the acute onset of symptoms followed immediately after instrumentation. Five of Randall's 8 cases gave a history of previous urethral manipulation; such as, deep injections, passage of sounds, irrigations with potassium permanganate and catheterization.

In the series of 43 cases reported in this paper, a history of urethral instrumentation preceded the onset of symptoms of prostatic abscess in 17 cases. Of this number, 5 were gonorrhœal and 12 nongonorrhœal.

CASE 3. A. L., age 44. Acute gonorrhœa 2 years ago. Patient has been under treatment off and on for this infection ever since onset. For several weeks prior to admission to hospital, he was under treatment by his family physician, who treated him with irrigations and the passage of large sounds. Three

days before admission and after the passage of sounds, he developed an acute attack of retention. This was associated with pain in the region of the rectum and in the perineal region. Before the onset of the retention, he was obliged to urinate four or five times at night, and the force of the stream was diminished. A slight amount of dribbling occurred after urination, which was associated with burning. After onset of the retention, patient had several attacks of chills and fever.

*Examination.* A slight discharge at the external urethral orifice. External genitalia, negative; Wassermann reaction, negative; gonococcal complement fixation test, negative. Blood examination showed 11,800 leucocytes. Urinalysis: Specific gravity 1,022; reaction, acid; albumin, blood, and pus, positive.

Rectal examination showed an enormous enlargement of the prostate which nearly filled the pelvis, with swelling more marked on the left side. Fluctuation could be elicited.

A perineal operation was performed and the abcess drained.

Examination of the pus showed Gram-negative diplococci = gonococci.

CASE 4. E. S., age 47, referred by Dr. Daniel E. Murphy. The patient had had an acute gonorrhœal infection about 15 years before, from which he apparently recovered. In April, 1919, he was operated upon for a rectal abscess and in December, 1919, was operated upon for a fistula in ano.

Four weeks before admission to hospital, a No. 26 sound was passed and this was followed by a small amount of peri-urethritis. Later, several sounds were passed. After the passage of the last sound, patient developed frequency of urination, being obliged to void every half hour during the day and twenty times at night. Two days before admission to hospital, he developed pain located in the rectum and along the urethra. This pain was associated with the act of urination. He complained also of some difficulty in starting the stream. Two days prior to admission to the hospital, patient developed complete retention which necessitated his being catheterized three times. Also had chills and fever for a week before admission. A great desire to urinate, but was unable to void.

*Examination.* Scar from the operation for fistula in ano. A bean-sized lump was seen in the middle of the anterior urethra. Blood examination showed 15,600 leucocytes. Wassermann reaction, negative; gonococcal complement fixation test, positive 4+. Rectal examination showed the prostate enlarged and the right lobe about three or four times the normal size; the surface smooth.

Abscess ruptured into the urethra 2 days after the onset of retention. Following the rupture, patient had relief of symptoms and a return of normal urination.

Streptococci were found in the pus expressed from the prostate. No gonococci were found. Blood culture, negative.

## ABSCESS OF THE PROSTATE ASSOCIATED WITH BENIGN HYPERTROPHY

When an abscess of the prostate without hypertrophy occurs in elderly men a diagnosis of benign hypertrophy is made, as a rule, and the abscess is not recognized. When the abscess with hypertrophy occurs in elderly men the abscess is often overlooked and a diagnosis of hypertrophy is made. At times, the differentiation may be very difficult, and cases have been reported in which the abscess was not recognized until the bladder was opened to remove a suspected enlargement of the gland.

In one case, a diagnosis of hypertrophy was made by the family physician and the presence of the abscess was not recognized. There was no enlargement of the lateral lobes *per rectum*. Cystoscopic examination showed a small median bar and rectal examination showed an abscess in one lobe. In the second case, a diagnosis of hypertrophy was made and found to be present, although the presence of the abscess had not been recognized before the patient was admitted to the hospital. In the third case, beginning enlargement of both lateral lobes and a small bar were demonstrated cystoscopically after operation for abscess.

One of the cases had complete retention of urine, necessitating catheterization every 6 hours. The retention was present for a fortnight prior to his admission to the hospital.

CASE 5. J. F., age 67. Venereal infection denied. Patient was admitted to hospital because of complete retention. Had been having more or less bladder distress for about a year, which necessitated voiding from one to three times at night. Frequency was very materially increased 4 days prior to admission to hospital. Two weeks before admission, he had a chill and was unable to void; he sent for a doctor and was catheterized. Since that time, with exception of 2 days, catheterization every 6 hours.

*Examination.* External genitalia, negative, except for a large hydrocele on the right side. No urethral discharge. Examination of blood showed a leucocytosis of 14,400. Blood pressure: systolic, 136; diastolic, 80. Urinalysis: specific gravity, 1,020; cloudy; acid; trace of albumin, a few leucocytes, bacteria, and amorphous urates.

Rectal examination showed an enlarged prostate, the apex of which could easily be reached. Infiltration was present on the right side, extending to, and apparently filling, the bony pelvis. Prostate was soft in consistence and fluctuation was elicited.

During rectal examination, the abscess ruptured into the urethra. A large amount of bloody pus was obtained.

Examination of the pus showed a pure culture of staphylococcus albus.

CASE 6. G., age 60, referred by Dr. George Parker. Venereal infection denied.

Patient complained of burning on urination and more or less pain in the urethra. A gradual increase in frequency of urination developed, compelling patinet to void every 2 hours, both day and night. Symptoms gradually increased in severity. About a week later, patient noticed great difficulty in urinating, being obliged to strain a great deal in order to start the stream. The difficulty became rapidly worse until finally there was inability to void and catheterization was necessary.

*Examination.* External genitalia, negative; no urethral discharge. Rectal examination showed a large, fluctuating mass in the right lobe of the prostate. The abscess was about the size of a plum and bulged into the rectum. Fluctuation could be elicited.

Cystoscopic examination showed a well-defined median bar and a beginning hypertrophy of the lateral lobes.

The abscess was opened through the rectum and patient made an uneventful recovery.

CASE 7. J. McG., age 48. Venereal infection denied.

Patient stated that he had had more or less urinary frequency for 10 years, but the frequency was not constant. Complained of intermittent pains in the pelvis and above and behind the symphysis pubis. Some difficulty of urination; at times the stream was split. Two days before entering hospital, patient suddenly developed complete retention of urine which necessitated catheterization.

*Examination.* External urethral orifice, negative; no discharge. External genitalia, negative. Roentgen-ray examination, negative. Blood examination showed a leucocytosis of 10,000. Wassermann reaction and gonococcal complement fixation tests were negative.

Rectal examination showed the left lobe of prostate enlarged; surface smooth, fluctuation elicited.

A perineal operation was performed and the abscess drained.

Cystoscopic examination revealed a notch above, with slightly intravesical protrusion of the lateral lobes and a definite bar at the base.

### ABSCESS OF THE PROSTATE ASSOCIATED WITH URETHRAL STRICTURES

One of the patients had suffered from urethral strictures for many years. These had been treated very irregularly with sounds. The passage of sounds gave him a great deal of symptomatic relief which, however, was only of short duration, necessitating the use of sounds every few months. The last sound was passed 7 weeks before the onset of symptoms of abscess of the prostate. Undoubtedly, the chronic urethritis and the frequent instrumentation were predisposing factors in producing the abscess.

Lasio has recently reported a case of abscess of the prostate due to stricture.

CASE 8. F. C., age 39, referred by Dr. Charles Schott. Patient had urethritis, in 1898, of 4 months' duration; treated with irrigations. In 1916, patient had a very severe attack of bilateral bacillus coli pyelitis. Examination at that time showed the presence of the pus cells in the strippings obtained from his prostate. Seven weeks prior to onset of present trouble, patient had a great deal of difficulty in urination, for which sounds up to and including No. 25 French were passed.

One week prior to onset of abscess, patient was confined to bed, because of an attack of left-sided epididymitis. Frequency of urination present since onset of acute epididymitis, and this was associated with difficulty in urination; hence, urination was very slow and required a long time to empty the bladder. Associated with urination, there was a great deal of suprapubic pain radiating over the lower abdomen. Patient had chills, fever and sweats, and ran a temperature oscillating between 101° and 104° F.

*Examination.* External genitalia, negative. Right epididymis, negative; left epididymis, very sensitive and enlarged. Rectal examination showed the prostate enlarged to about three times its normal size. In the center of the prostate was a soft area, and in this area it was possible to elicit fluctuation. The rest of the prostate was hard. Both seminal vesicles were palpable.

A diagnosis of abscess of the prostate was made and patient advised to have the abscess opened through the perineum.

During the night the abscess ruptured into the urethra. Following the rupture, a large amount of pus was discharged from the urethra. Temperature rapidly returned to normal and the patient was relieved of his symptoms.

### ABSCESS OF THE PROSTATE FOLLOWING APPENDICITIS

Whether or not there is any causal relation between abscess of the prostate and appendicitis, I am not prepared to state. Abscess of the prostate, as a remote complication of appendicitis, is not mentioned in textbooks on general surgery or on genito-urinary surgery; hence, when it occurs as a complication it may be only an incident. Nevertheless, in view of the fact that the patient, whose case

report follows, had an appendical abscess which was opened and drained, necessitating his being in the hospital for 19 days, and also in view of the fact that urethral instrumentation was not used, and no evidence of acute or chronic gonorrhœa obtained, one would be justified, apparently, in assuming that there may have been a causal relation between these two conditions.

CASE 9. C. G., age 23, referred by Dr. Dean D. Lewis. Venereal infection denied.

Patient was operated upon for acute suppurative appendicitis by Dr. Lewis and the appendix removed. Patient remained in hospital 19 days and left in good condition. Twelve days after leaving, he returned, complaining of inability to pass his urine, at which time he was catheterized and the catheter passed quite readily. Went home and returned the next day, because of inability to urinate. At this time a No. 21 French sound was passed and no obstruction found.

*Examination.* Negative, except for a recent scar in the appendix region. External genitalia, negative. Blood examination showed a leucocytosis of 11,700 and hæmoglobin of 90 per cent. Blood pressure: systolic, 150; diastolic, 108. Urinalysis: specific gravity 1,020, turbid, amber; albumin, red blood cells and bacteria, positive.

The cystoscope was introduced into the bladder with a little difficulty owing to an apparent obstruction in the deep urethra. This resulted in the rupture of an abscess with an outflow of a large amount of thick, yellow pus. This was followed by an immediate relief of his symptoms.

Rectal examination showed the prostate large and very hard. (The examination was made at once.) By applying pressure on the prostate a large amount of pus was seen exuding from the external urethral orifice.

### ABSCESS OF THE PROSTATE WITH CALCULI

This combination is a very rare one. Cases have been reported in which the abscess ruptured and a fistula remained. Calculi have been removed through the fistulous opening. Cases of this kind have been reported by Dupuytren, Joshua, Crosse, Baker, and Devin. Lydston recently reported 2 cases of stone and abscess of the prostate. In one case he removed a calculus from the abscess cavity; in the second, a perineal abscess was opened by the patient's physician and a stone weighing 700 grains removed.

One case in this series belonged to this group and calculi were diagnosed at the time of the patient's first admission to the hospital. This case was reported[1] in detail when the patient first came under observation. The abscess was a part of his terminal illness.

CASE 10. F. A. K., age 57. At eighteen patient had a lesion which was diagnosed as a chancre. Last attack of urethritis, 20 years ago. Patient had occasional attacks of pain in the hypogastrium. Attack of cystitis 2 years prior to onset of trouble.

Patient complained of frequent inability to urinate, frequency of urination, pain after urination and incontinence. Incontinence began 4 weeks before admission to hospital. Difficulty in starting stream was variable. Sometimes patient could not start the stream at all, and at other times he could only start the stream after sitting down and waiting.

The stream was slow, lacked force, and dribbled.

*Examination.* Pupils, irregular. Finger-to-finger test showed a slight inco-ordination. Pain sensation diminished in arms, chest, abdomen, and legs. Dr. Bassoe saw patient in consultation, and a diagnosis was made of scattered areas of degeneration both in motor and sensory areas, probably dependent upon arterial changes. Blood examination showed 10,200 leucocytes. Blood pressure: systolic, 165; diastolic, 65. Urinalysis: Specific gravity, 1,005; albumin, sugar, and blood, negative; a few granular casts. Wassermann reaction, negative; spinal Wassermann, positive. Cultures of the urine were sterile. Roentgen-ray examination showed the presence of multiple calculi in the prostate. Patient remained in hospital for several weeks and was discharged February 20, 1917.

Patient re-entered hospital, October 31, 1917, and was admitted to the medical service of Dr. James B. Herrick. Complained of shortness of breath, swollen feet, incontinence of urine, and headaches. On the medical service 21 days, and died November 20, 1917.

The autopsy was performed by B. O. Raulston, pathologist, Presbyterian Hospital. The following postmortem report is taken from his protocol:

Primary abscess of the prostate gland. This abscess contains thick creamy pus. Pus distended seminal vesicles. Thick pus exudes from the seminal vesicles. The lining of the urinary bladder is markedly hypertrophied; hyperæmic, but more hyperæmic in the prostatic region. Marked dilatation of the ureters and pelves of the kidneys containing pus. Hyperplasia of the peri-aortic lymph glands. Slight œdema of the lungs. Marked senile sclerosis of the aorta. Chronic myocarditis. Beginning aortic aneurism. Bed-sore of the lumbar region.

### CASES IN WHICH THE ETIOLOGY WAS NOT DETERMINED

In some cases no apparent cause for the abscess could be found. The usual clinical and laboratory methods of examination failed

[1] Kretschmer, Herman L., Surg., Gynec. & Obst., 1918, xxviii, 70.

to demonstrate any possible etiological factors. It is in this group of cases that not only the adjacent viscera (urethra, rectum, etc.) should be carefully examined, but the possibility of distant foci of infection should be borne in mind. Various lesions of the rectum, such as fissures, fistulæ, abscess, ulcers, hæmorrhoids, etc., have all been mentioned as factors in the production of prostatic abscesses.

Recently, attention has again been called to the rôle of rectal lesions in prostatic abscess; by Brooks, Wilson and McGrath, Motz, and Vogel.

The possible rôle of distant foci, as an etiological factor, has undoubtedly not received as much consideration as it should. In this group of cases, careful examination should be made of the teeth, tonsils, and sinuses, as a routine. The case mentioned in the first part of this paper, in which the prostatic abscess developed after an acute attack of tonsillitis, seems to be of more than passing significance.

As an example of this group, the following will serve as an illustration:

CASE 11. Wm. K., age 48. Venereal disease denied. In 1913 patient had an attack of appendicitis. In 1914 he had an attack of right-sided renal colic at which time many blood cells and casts, it is stated, were found in the urine. The present illness was sudden in onset and began with indefinite abdominal pain, general at first; later this was localized in lower abdomen. The entire abdomen was sore. This was followed by severe burning in and along the urethra. Patient said that he felt as though he had obstruction to urination and that it was necessary to urinate every half-hour to one hour at night, only a small amount of urine being passed each time. There was some interruption of the stream; and although the amount of urine voided each time was very small, the stream was often interrupted before the act was completed. When seen by his family physician, patient had not voided for 6 hours. Had had severe pain in the rectum and defæcation was very painful. A diagnosis of retention was made by his physician; a catheter was passed, but the bladder was found to be empty.

*Examination.* External genitalia, negative; no evidence of acute or chronic urethral discharge. Rectal examination showed an enlargement in the left lobe of the prostate, which was very painful to touch. Fluctuation could be elicited.

Roentgen-ray examination, negative. Wassermann reaction, negative. Examination of blood on October 3, 1919, showed 11,800 leucocytes; October 5, 30,000 leucocytes; October 15, 9,000 leucocytes.

The abscess ruptured into the urethra.

Examination of the pus showed the presence of staphylococci and streptococci.

For purposes of discussion, the cases falling into this category may be divided into the following three groups:

GROUP 1. An important point to remember in connection with abscess of the prostate is that the clinical picture may be that of general sepsis, masking or overshadowing the prostatic symptoms to so great an extent that the true nature of the patient's illness is not discovered until late in the course of the disease, and a diagnosis of general sepsis is made. At times a diagnosis of typhoid, chronic malaria, etc., is made. A case of this type was reported by Brooks in which a diagnosis of paratyphoid was made but not proved. The onset of painful defæcation in about the third week of the patient's illness lead to a rectal examination which revealed the presence of an abscess of the prostate.

GROUP 2. Under this heading may be considered cases of abscess of the prostate in which the abscess is part of a general sepsis and in which evidence of general sepsis is present. The case to be reported below seems to belong to this group.

GROUP 3. General septic infection may have its origin from suppuration of the prostate. A case belonging to this group has been reported by Roessle.

The patient had been kicked by a horse; the spleen was ruptured. There was an exudate in the splenic area, and after aspiration, fever and retention of urine set in. A perinephritic abscess was drained. Death occurred seven weeks later, from general sepsis. The autopsy revealed suppuration of a subphrenic hæmatoma; healed rupture of the spleen; embolic abscesses of both kidneys. The oldest pus focus was found in a complete suppuration of the prostate.

CASE 12. M. H., age 45, admitted to hospital in a semicomatose state. Venereal disease denied. Four years ago, patient had an attack of retention of urine. Frequency of urination began 8 months ago and has been present ever since, patient being obliged to urinate every 3 hours, both day and night. In all, he has had eight or nine attacks of retention. Some of these were relieved by the use of hot baths and hot applications. Last attack, 4 days ago, relieved by hot baths. Last catheterization, 5 months ago. Was catheterized only once with a soft rubber catheter and that went in with difficulty. Urgency of urination is very marked and the patient

has no power to withhold the impulse of urination when it occurs; hence, the wearing of a rubber urinal is necessary.

*Examination.* Patient is very sluggish mentally: answers questions very slowly. Exploration of the urethra reveals the presence of many strictures in the anterior urethra. Hæmorrhagia spots on the skin. No urethral discharge. External urethral orifice and scrotum, excoriated. Roentgen-ray examination of the genito-urinary tract, negative. Examination of blood shows 15,500 leucocytes.

Patient's mental condition rapidly became worse; more and more drowsy. Death occurred 3 days after admission to hospital. Permission for a complete autopsy could not be obtained. Autopsy revealed the following findings:

The spleen was enormously enlarged and showed the presence of many infarcts (chronic septic spleen). Liver was negative. Both kidneys indicated the presence of a very severe hæmorrhagic nephritis; many recent infarcts. An abscess was found in the prostate and there was a very large abscess around the prostate. Many ecchymoses of the skin.

From the autopsy findings it seemed justifiable to assume that the patient was suffering from a general sepsis and that the abscess in and around the prostate was a part of his general sepsis.

### SYMPTOMS

Once the abscess has developed, there does not appear to be any difference in the symptomatology, in the venereal and nonvenereal cases, except as regards the presence of an acute or chronic discharge. An analysis of the more common symptoms shows that they were present in both groups. For this reason they will be considered together.

*Frequency of urination.* This was present in 34 of the 43 cases. Although the most constant of all urinary symptoms present, frequency of urination varied greatly in its intensity in the individual case. Thus, where in some cases there was only a slight increase in frequency, in others it was so well marked that the patients were obliged to void every 2 hours, both day and night. In 7 cases the patients were obliged to void every 15 to 30 minutes, both day and night.

*Pain.* Pain in one form or another was almost constantly present. Thirty-six of the 43 cases had pain. In some the pain, which was suprapubic, was present only when the bladder was distended; relief came promptly with catheterization. Perineal pain was present in 11 cases, in 14 the statements made indicated perineal fullness associated with pain.

Pain, associated with or aggravated by micturition, characterized 22 cases. In some the pain was present before, and in others both before and after, urination. In some the pain was in the neck of the bladder, and in a small number it was referred to the lumbar region.

*Retention of urine.* In 14 cases in this series complete retention of urine occurred; hence, catheterization before or after admission to the hospital was carried out. Practically all 14 cases came to the hospital seeking relief from retention. The duration of the retention was variable. In one case retention was present a fortnight prior to admission. This was the longest duration of retention in this series. The following duration was noted in the remaining cases: 8 days—1 case; 7 days—3 cases; 3 days—1 case; 2 days—4 cases; 1 day—1 case; 12 hours—1 case; and in 2 cases the catheter was used only once. Of these 14 cases, 8 instances of retention were complications of gonorrhœa and the remaining 6 occurred in nonvenereal cases. In these 6 cases, the retention occurred under the following circumstances:

(1) Previous operation for appendicitis; (2) osteomyelitis of finger; (3) carbuncle of neck; (4) passage of sounds; (5) benign hypertrophy; (6) no cause found.

*Difficult urination.* Synchronously with an abscess in the prostate there occurs a definite enlargement. As a result of this, one would naturally expect some difficulty in urination in a certain number of cases. In this series there were 23 cases in which this difficulty was more or less characteristic.

*Rectal symptoms.* These symptoms occurred in 25 cases and were described as painful defæcation in 10 cases. Pain in the rectum was a disturbing element in 11 cases, and abnormal sensations, such as a feeling of warms or fullness, were complained of in 2 cases. Ten cases were free from rectal symptoms. In 9 cases no record of the presence or absence of rectal symptoms was noted.

Of the 25 cases presenting rectal symptoms, 20 were due to abscess of gonorrhœal origin and 5 were nonvenereal.

*Chills and fever.* Nineteen cases were subject to these disturbances.

*Rectal findings.* In all the cases definite changes in the prostate were elicited upon rectal examination. In each case rectal examination gave evidence of pain and tenderness in the prostate as well as changes in size and consistence.

In the well advanced or well developed cases of abscess, the diagnosis is easy. In the early cases, in which the abscess is small, that is, before there has been much destruction of prostatic tissue, there may be some doubt about the diagnosis. In several cases the presence of a definite circumscribed area of pain and tenderness was of assistance as regards recognizing the cases early and permitting early surgical intervention. When the abscess is large, fluctuation can readily be elicited.

In 13 cases rectal examination revealed the location of the abscess in the left lobe, and in 10 cases in the right lobe. In the remaining cases no specific reference to one lobe or the other was noted.

COURSE

The three possible terminations of an abscess of the prostate are (1) resolution, (2) rupture, (3) operation.

One case left immediately after the diagnosis was made and further data were not obtainable. Two cases were found at autopsy.

1. *Resolution.* In this series there were only 4 cases that went on to resolution. Thus it will be seen that the total number of cases that go on to resolution is small.

2. *Rupture.* In 19 cases the abscess ruptured into the urethra. The factors which were associated with rupture were variable. Some ruptured spontaneously, or while straining at stool; some without any apparent factor being present as the cause; and others during rectal examination, although the examination was made carefully and without undue force.

In several instances the amount of pressure exerted by the finger in the rectum was increased in order purposely to cause the abscess to rupture into the urethra. Needless to state, this is not practiced or recommended as a routine procedure.

In 1 case the abscess pointed alongside the rectum; hence, it might easily have been mistaken for an ischiorectal abscess.

When an abscess of the prostate points alongside the rectum or when it appears above the symphysis pubis, it should no longer be considered a true abscess of the prostate. Some authorities are of opinion that this sort of abscess is a periprostatic suppuration or phlegmon, but most authorities call it a periprostatic abscess. Averseng and Dieulafoy have made exact anatomical, experimental, and pathological studies upon the site and upon the sheath-investing membrane of the prostate, and, according to their findings, have demonstrated that besides the prostatic capsule, as they call it, there is a periprostatic aponeurosis, arranged in such manner that interspaces are formed in front, laterally, and behind the prostate, which are of great importance, since they may be the seat of isolated abscess formations. According to these authors, true periprostatic abscesses lie within the prostatic aponeurosis, between the latter and the prostatic capsule, and originate through direct contact with suppuration of the gland. Abscesses situated outside the aponeurosis in the cavum retzii, in the perirectal space, etc., arise from extension of infection by way of the lymphatic vessels and the veins. They do not form encapsulated abscesses, but appear as diffuse phlegmons. These anatomical relations point to the necessity, when opening a periprostatic abscess, of making sure that no other encapsulated abscesses are present in the interspaces above described. Blum reports 1 case in his series in which the abscess appeared as an enormous tumor over the symphysis, simulating a distended bladder.

3. *Operation.* Sixteen cases were operated upon and no operative deaths were recorded.

One of the abscesses was opened through the rectum by the local physician; the abscess was very large and protruded into the rectum; hence, it was a simple procedure. Formerly, this route was the one resorted to very often and very freely; at present it is rarely, if ever, used. The patient made a prompt recovery and there were no unpleasant sequelæ.

As mentioned above, one of the abscesses pointed in the ischiorectal fossa. This was opened by an incision alongside the rectum, just as in any other ischiorectal abscess.

The remaining 14 cases were operated upon by the perineal route. The usual lateral incision employed for perineal prostatectomy was used. The abscess in the prostate was incised with a scalpel or occasionally the abscess was opened by thrusting into it a pair of blunt pointed forceps. The urethra was not opened; it was our object to avoid opening the urethra and in this way prevent a urinary fistula which would prolong convalescence. At the present time the perineal method of draining prostatic abscesses is the method of choice. Care should be exercised, after opening the abscess to insure thorough drainage; that is, to preclude the possibility of another abscess being left behind. To this end the septa between the abscesses should be broken down with the finger.

If the abscess is located in only one lobe, that lobe only is opened. If both lobes are involved, both are incised at one sitting.

The treatment of abscess of the prostate does not differ from the treatment of an abscess in any other organ, where the dictum is to make the diagnosis early and to drain.

Perhaps the policy of watchful waiting has been instituted and encouraged, because a large number of cases tend to rupture into the urethra, if one waits long enough. This delay—waiting for something to take place—must necessarily be at a certain expense of the prostate; for if our object is to conserve the functions of this organ, it would appear the right sort of treatment to make the diagnosis early—namely, before much destruction of gland tissue has taken place and then to institute proper surgical intervention. Furthermore, spontaneous rupture may, at times, be insufficient for proper drainage; hence, an infected cavity remains which may be the cause of a chronic discharge or of subsequent attacks of abscess formation.

One case developed epididymitis after the operation, and another, an urethral fistula on the third day after the operation. This was entirely healed at the time the patient left the hospital.

One factor which seems to be of sufficient importance to discuss, is the importance of the after-care of the patient after the abscess has healed. Our method has invariably been not to dismiss the patient as cured because the abscess was healed.

Careful massage of the prostate followed by microscopic examination of the strippings revealed the presence of pus. In view of this fact, it would appear important that these patients should be carried through to a point where the prostatic strippings are free of pus. This has been our routine—at least, we have attempted to carry it out whenever the patient would co-operate with us.

Our duty toward a patient is not fulfilled and remissness obtains, if we allow him to leave so long as the prostatic strippings still show pus. At times, one meets with a patient who is surprised to learn that further treatment is necessary after the operation—a procedure which is not readily understood by him, since he regards the operation all that is necessary to effect a cure.

## SUMMARY

1. Abscess of the prostate occurs more frequently than is generally recognized.

2. Infected abscess cavities, which drain poorly and have ruptured into the urethra, may occasionally be factors in keeping up a chronic urethral discharge, or may lead to recurring exacerbations of acute prostatitis.

3. Nongonorrhœal abscess is not an uncommon occurrence.

4. Early surgical intervention—namely, incision and drainage, is a rational method of handling these cases and does not differ from the surgical treatment of abscess occurring in other organs.

5. Operative treatment doubtless shortens the duration of the disease.

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# PREGNANCY WITH DEATH OF THE FŒTUS AND FAILURE OF EFFORTS AT SPONTANEOUS DELIVERY, RESULTING IN MACERATED FŒTUS AND PERFORATION OF ABDOMINAL WALL; OPERATIVE REMOVAL; RECOVERY

By F. R. CRAWFORD, M.D., Kashing, China

WE recently received a case on our surgical service, General Hospital No. 20-807, which is of sufficient interest to justify its being placed on record. In a country such as China a medical practitioner constantly sees cases that have been neglected for weeks or months, partly through ignorance and partly through fear of western methods. The thing that constantly surprises one seeing such cases is the fact that they survive. The outdoor life led by the country people, men and women being out of doors practically the whole time 8 or 9 months a year, and their houses being of such construction that they secure fair ventilation, even against their will the remaining months, undoubtedly has very much to do with their ability to resist infection. This case is a striking example of what the human organism can stand and is also interesting from a diagnostic standpoint. A history giving the essential points is herewith presented:

The patient, a young country woman 26 years of age, was admitted to the Kashing Hospital, on July 21, 1920. Her family history and her personal history prior to the beginning of the present trouble are not recorded, except that she is married and the mother of two healthy children.

*Present illness.* As to the date of her last menstrual period the patient is not perfectly clear, but from her statements it occurred some time during the month of December, 1918. A pregnancy which seemed in all points normal dated from this time and continued until some time between the 20th and 25th of September, 1919, when fœtal movements ceased. Following this about one week, the membranes ruptured, there being a "great rush of water," and a midwife was called. She expected labor to set in. This, however, was delayed until October 7, when pains, which she describes as being true labor, commenced. To use her words, however, the pain lasted only "half a night." She does not give a history of exceptionally severe pain, nor is there any history pointing to severe shock. She states that the vulva became much swollen. No blood was passed until 2 days later when she passed considerable amounts of blood and a white cheesy material which she likened to "bean curd" (very similar to thick clabber). She passed material of this nature by vagina for 3 months. During this time the vulva was constantly swollen. After 3 months and until admission no blood was passed, but there was a constant purulent, offensive discharge. About 7 weeks before admission the abdomen opened spontaneously and about 2 weeks prior to admission a bone fragment was passed. The day before admission a second bone fragment was passed through the abdominal opening.

*Physical examination.* The patient is a young, frail looking woman, evidently quite sick. On inspection the abdomen showed a wound in the right iliac fossa, parallel to and about 2.5 inches above Poupart's ligament. This wound is about 4 inches long. The aperture is filled with a dirty, greyish mass, which on tapping proved to be bone. The lower abdomen is filled with a mass extending to about the level of the umbilicus and well out to the pelvic bones on either side. The abdomen is not markedly tender. The patient was admitted and ordered prepared for operation on the following day. The temperature on admission was 100° F. Urine examination made before operation showed nothing of note. The white blood cells were 9,000. The hæmoglobin was 70 per cent.

The patient was placed on the table in the dorsal position and after the administration of ether the abdomen was prepared with iodine. The wound proving to be sufficiently large to remove the bones of the skull no additional incision was made. After the skull bones had been removed a large cavity filled with fœtal remains was brought into view. This mass of material was rapidly removed manually and the cavity sponged out with hot saline. The cavity was found to extend to the level of the umbilicus and to occupy the whole of the pelvis. Further exploration revealed bone in the midline low down in the pelvis. After some little difficulty this was grasped with an artery forceps and removed. It proved to be a femur. The tibia and fibula were then recovered and digital exploration revealed the small bones of the foot deep in the pelvis. While attempting to seize these with the forceps it was found that they receded deeper. Digital exploration was again made and the finger followed the bones to and through the smooth, rounded external orifice of the cervical canal. This was further verified by having an assistant locate the cervix by vaginal palpation and then passing an instrument through the orifice and bringing it into contact with his hand. The

cavity was then again explored and packed with saline sponges. Owing to the grossly infected nature of the cavity it seemed best not to suture the wound. The patient was returned to the ward in good condition with instructions to be placed at once in the Fowler position.

Following the operation the course of the disease was rather stormy for a few days. The temperature, which was normal the morning of the day of operation, rose to 100.6°F. that afternoon and to 103° F. the following day. At this time the white blood count was 15,000. From this time on, her temperature gradually fell, reaching 99° F. the afternoon of the sixth day after operation. The day after operation there was a large amount of foul fluid discharge, seropurulent in character. After the second week, drainage was discontinued, a clean sinus having developed. The patient was discharged on the thirty-fifth day. At this time the wound had entirely healed except for a small granulating surface which would require only a few days to be covered with skin.

The case presents difficulties in diagnosis. It would seem that the condition found might have had any one of three causes: Ectopic gestation followed by false labor which came on after the death of the fœtus; missed labor with subsequent perforation of the uterine wall; ruptured uterus at time of labor.

In discussing the question of missed labor, Williams in his *Textbook on Obstetrics*, second edition, warns against confusing the condition with false labor in ectopic gestation. Missed labor is defined by Dorland as: "Retention of the dead fœtus *in utero* beyond the period of normal gestation," and seems to be a very rare condition.

When this woman was first seen, in the outpatient department, where she was carried in and placed upon the examining table, and the abdominal wound uncovered, the diagnosis of ectopic gestation with macerated fœtus at once presented itself. That such, however, was not the case seems certain from the history, later secured, of the discharge of amniotic fluid. That is, the condition originally must have been intra-uterine. At the time of operation it was impossible to state positively what the original position of the child had been. It seems perfectly fair to say, however, that it was a breech presentation, this deduction being based upon the position of the head in the right iliac fossa and the finding of leg bones well down in the lower uterine segment.

The fact that the right wall of the uterus was found to be lacking, down to about the level of the internal os, explains the means of escape of the child. It does not tell us, however, the method of rupture, whether a laceration at time of labor, or due to necrosis resulting from infection.

Williams states that the ordinary source of infection in cases of ectopic gestation when the fœtus is retained and becomes macerated, is intestinal. In this case the direct implantation of infectious material into the uterine cavity by the hands of the midwife would seem probable and certainly could not be ruled out. The author believes it possible that the uterine contents were infected by the midwife when first called; that this infection spread to the uterine wall, possibly at the site of implantation of the placenta, and resulted in a slough allowing the escape of the child into the folds of the broad ligament, the process progressing gradually until the condition as seen on admission was produced. This, however, does not seem probable.

Hence the first possibility of ectopic gestation seems ruled out, the second, missed labor, with infection is improbable, and by the process of elimination, we are forced to conclude that it was probably a case of rupture of the uterus. Why the uterus should have ruptured in a case of this kind is not clear. Labor pains were not severe and lasted only a few hours. No history of an infection prior to labor was obtained, but such an infection is a possibility. If the uterine contents were infected and an interstitial infection produced, this might have so weakened the wall as to render that portion less resistant than the cervix, with a resultant rupture, rather than dilatation. Were there such an infectious process it might account in part for the fact that the woman did not die of shock; the pressure resulting from the inflammatory products partially occluding the larger vessels. The fact that the child only partially escaped from the uterus, thus bringing pressure on the lacerated tissues, doubtless was the chief factor in the control of the hæmorrhage.

# DEPARTMENT OF TECHNIQUE

## A SIMPLE INCISION FOR OPERATIONS ON GASSERIAN GANGLION

By F. E. McEVOY, M.D., Rochester, Minnesota[1]
Fellow in Surgery, The Mayo Foundation

THE first successful intracranial operation for the relief of trifacial neuralgia was performed in 1890. Since that time the technique of the operation has been simplified greatly by the use of specially adapted instruments, particularly the illuminated retractor employed by Adson and by Frazier, and by improvement in the types of incisions introduced, each simpler and less time-consuming than its predecessor. In selecting the incision three important factors should be borne in mind: (1) avoidance of injury to the temporal branch of the facial nerve, (2) ample exposure, and (3) limitation of disfigurement.

Hartley and Krause introduced a horseshoe osteoplastic flap incision with its base immediately above the zygoma, but without resection of the zygoma. The frequent injury to the temporal branch of the facial nerve was the most disappointing feature of this incision.

Cushing suggested a musculocutaneous horseshoe flap incision with its anterior limb sufficiently short to avoid injury to the upper branch of the facial nerve. In this approach temporary resection of the zygoma with removal of bone down to the foramen ovale was advocated. Cushing is now using a musculocutaneous incision without resection of the zygoma. The objection to this incision is the mass of muscle above the zygoma, which interferes with the low approach to the middle fossa.

The question mark incision devised by Frazier has been in common use. The incision is entirely within the hair-line; the anterior limb begins 3 centimeters behind and above the external angle of the orbit. A fascial flap is turned in the opposite direction from that in the scalp, and the temporal muscle is incised in the direction of its fibers. The principal objection to this incision is the possibility of injuring the temporal branch of the facial nerve from retraction or from severance, and the time required in making and in closing it.

The incision used in the Mayo Clinic for the last few months has distinct advantages: (1)

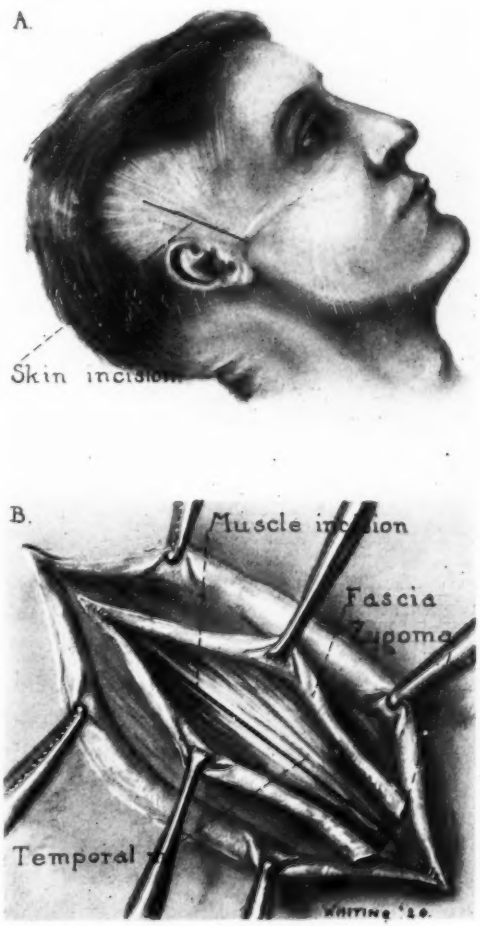


Fig. 1. *a*. Scalp incision beginning at the lower edge of the zygoma and extending upward in the direction of the temporal muscle fibers. *b*. Incision in temporal fascia showing the transverse incision at the lower angle.

[1] From the Section on Neurology, Division of Surgery.

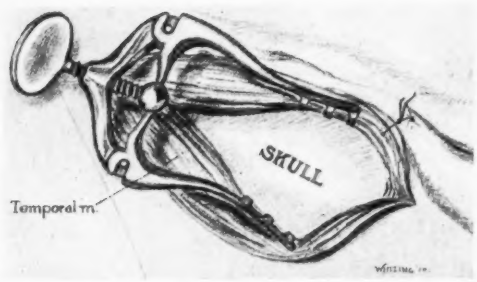


Fig. 2. Self-retaining retractor in place exposing temporal bone.

it is simple and can be rapidly made and closed, (2) it precludes the possibility of injury to the temporal branch of the facial nerve, (3) it is entirely within the hair-line and leaves no visible scar, and (4) it prevents the swelling so prone to occur about the orbit in flap incisions.

The incision begins at the lower border of the zygoma, 1 centimeter in front of the ear, and extends 8 centimeters backward and upward in the direction of the fibers of the temporal muscle. The incision is extended through the skin, fascia, and muscle, but in addition the temporal fascia is divided parallel with the zygoma for a distance of 0.5 centimeter in each direction from the oblique incision, thus affording greater exposure of the lower angle. A self-retaining retractor is used to expose the bone for decompression with removal of bone down to the floor of the middle fossa (Figs. 1, 2, and 3).

Elsberg, of New York, in a personal communication states that he has employed a similar incision with entire satisfaction.

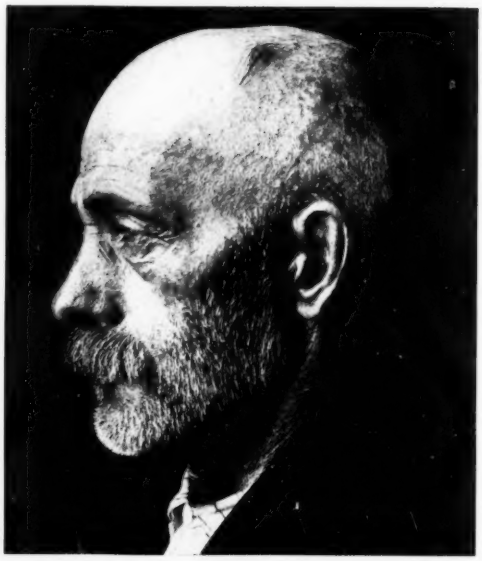

Fig. 3. (A326986.) Photograph of wound 10 days after ganglion operation.

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# A PIN METHOD FOR THE APPROXIMATION OF THE FRAGMENTS IN FRACTURED PATELLA

By ARTHUR E. HERTZLER, M.D., F.A.C.S., Halstead, Kansas

A YEAR ago while visiting Dr. G. A. Nickelson, of Plains, Kansas, he showed me a patient on whom he was using a method for the reduction of fractured patella, which he believed was original. I cannot say whether or not the method is original, but if not original I have failed to find a description of it. At any rate the method is not as well known as its merit deserves.

The procedure is as follows: Strong pins are passed through the tendons as close as possible to the patella. The pins are then approximated by means of bandages or adhesive strips (Fig. 2). This brings the broken fragments in close approximation (Fig. 1).

The case from which the above pictures were obtained had the patella fractured in an automobile accident. The fragments were fairly widely separated (Fig. 3). The pins used here were long bone drills. The skin was anæsthetized with novocaine at the point of proposed insertion and the exit of the pins. The drill handle was used to force the pins through.

The pins were at no time complained of and the degree of irritation was at no time noteworthy. The leg was supported by a splint but this was removed from time to time and the knee exercised. Good functional result and bony union resulted.

The advantage of this method is that the bones can be certainly approximated without entering the knee-joint. It is capable of being used, as Dr. Nickelson uses it, far away from the facilities that are essential for an open operation.

Fig. 1.

Fig. 1. Roentgenogram showing the close approximation of the fragments of the fractured patella after the pins had been drawn together by adhesive as shown in Figure 2.

Fig. 2.

Fig. 2. The pins are in position and are held together by adhesive.

Fig. 3.

Fig. 3. Roentgenogram of the patella before the fragments were approximated.

# SLING SUSPENSION METHOD OF EXERCISE IN INFANTILE PARALYSIS

By FRED J. GAENSLEN, M.D., F.A.C.S., Milwaukee, Wisconsin

DURING the past months a system of exercises has been employed as an aid in selected cases of infantile paralysis which seems to have sufficient merit to make a report worth while. Briefly, the method consists in suspending the extremities to be exercised in a sling in mid-air to eliminate entirely both gravity and friction as hindrances to the to and fro motion. It is generally conceded that voluntary motion, involving as it does physiological exercise of the entire neuromuscular mechanism, is of vital importance in restoration of muscle power. Any method, therefore, which facilitates this function, should be of value. In the method to be described very slight muscle power can be translated into actual movement. Morever, very slight gains in power are measured by appreciable increase in the arc of motion. The mental stimulus to both patient and parent or teacher is a factor of importance in enlisting their best efforts in systematic and persevering application to the long and at best tedious task. The method is best adapted to those cases having the merest trace of demonstrable power or at any rate insufficient power to raise the limb against the force of gravity, or to move it against the friction of the examining table. When the weakness is less pronounced graduated resistance may be offered and comparative tests by the spring balance method devised by Lovett can be readily carried out.

The simplicity of the procedure will recommend it especially in cases where it is not possible to put a skilled nurse in charge. At the first examination of the patient, the weak muscles or muscle groups are determined and in a few minutes the special exercises necessary can be demonstrated so that anyone of average intelligence will understand them sufficiently for the carrying out of the work at home. Careful supervision by the physician of course is desirable so that modifications may be instituted in the carrying out of the exercises, to meet the special needs. The details of the method are perhaps best described by referring to the photographs.

Figure 1 shows the patient in position for exercising flexors and extensors of the hip. A broad cuff fixes the knee-joint. The extremity is suspended in a sling about the ankle and the patient is directed alternately to flex and extend the limb at the hip.

Figure 2 shows the patient in position for exercising the muscles controlling the knee-joint. The patient is seen lying on the left side, the sling under the right ankle (negative reversed in printing). The thigh above the knee is fixed either by the patient himself or by the instructor, and the patient alternately flexes and extends the knee. In order to avoid overstretching of the weakened quadriceps muscle, motion should be stopped at the position of 45° of flexion. Exercises 1 and 2 may be combined by using two slings, one just above the knee and the other about the ankle. In this way provision is made for flexion and extension of the knee alternating with the same motion for the hip, the knee being held fixed. When the knee is not fixed, flexion of both knee and hip may be carried out at the same time followed by extension at both joints, the motion resembling the alternate drawing up of the legs and kicking as in swimming. It may also be of advantage to do all of the above exercises in sequence, first flexion and extension of the knee, then flexion and extension of the hip with the knee extended, followed by combined flexion of the knee and hip and finally extension of both knee and hip. The slight pause will be of advantage for the individual groups. Rest periods should of course be insisted upon to prevent fatigue of muscles.

Figure 3 shows the patient in position for abduction and adduction at the hip. The patient lies on the back and the slings are passed about the ankle. In some cases it will be necessary to apply another sling about the knee to prevent hyperextension at the knee from gravity. Foot drop may be prevented by replacing the sling about the ankle by a special foot support.

Figure 4 shows the patient in position for flexion and extension at the elbow. The sling is applied about the wrist. The arm above the elbow is fixed by the patient or by the instructor. By shifting the sling to support the hand, flexion and extension of the wrist is facilitated.

Figure 5 shows the arrangement for forward and backward elevation of the arm. When the deltoid is weak these exercises should be done

Fig. 1. Position of patient and arrangement of sling for exercising flexors and extensors of hip. A broad cuff prevents flexion of knee. Two views taken on same plate.

Fig. 2. Arrangement for flexion and extension at knee. Thigh should be fixed by instructor or patient. Two views taken on same plate.

Fig. 3. Arrangement for exercising of abductors and adductors of thighs. Two views taken on same plate.

Fig. 4. Arrangement for flexion and extension at elbow. Upper arm fixed by instructor or patient.

Fig. 5. Arrangement for abduction and adduction of arm. Elbow fixed by means of cuff. Two views on same plate.

Fig. 6. Arrangement for forward and backward elevation of arm. Elbow fixed with broad cuff. Two views on same plate.

Fig. 7. Arrangement for flexion and extension of trunk on pelvis. Lower extremities should be fixed by instructor. Hammock should support thoracic portion of trunk only.

Fig. 8. Arrangement for exercising of muscles controlling lateral flexion of trunk. Hammock should support thoracic portion of trunk only.

with the arm maintained in slight abduction to prevent overstretching of the deltoid.

Figure 6 shows the patient in position for rotation at shoulder. When the deltoid is paralyzed the arm should be in a partially abducted position to prevent overstretching of the deltoid.

Figure 9 shows the position used in abduction and adduction of the arm. A broad cuff is applied about the elbow to provide fixation, while another supports the wrist.

Figure 7 shows the patient lying on the side, the trunk suspended in a hammock, for flexion and extension of the trunk and the hips. This hammock should be shorter than is shown in the illustration so that only the upper portion of the trunk is suspended, the legs being supported on a

Fig. 9. Arrangement for rotation inward and outward of arm at shoulder. Two views on same plate.

table or held by an assistant. In this way greater freedom of motion is secured for the erector spinæ and abdominal muscles.

Figure 8 shows the patient lying prone with the trunk suspended in the hammock and the legs fixed by assistant for the exercise of the muscles involved in lateral bending of the spine.

The alternate rhythmic contraction and relaxation of muscle groups and their respective antagonists as provided in the method outlined above is of advantage since it resembles in a way the action of muscles used in such exercises as walking. The same is true of the character of the motion, it being slow at first, more rapid in the middle phase, and slow again toward the completion of the movement.

The muscle power involved is very slight, so that there is little danger of fatigue, even if frequently repeated through the day. Overstretching of muscles should be prevented by limiting the arc of motion. It is also likely that the method can be applied earlier than other methods because of the gentleness of the movement and furthermore it can be used in cases of very young children who will co-operate in these simple swinging exercises when muscle training of the usual type is impracticable. In older children these exercises may be adjusted to their capabilities by offering resistance, or by asking them to do them on the count rather than pendulum fashion. The method is naturally not applicable to muscles controlling movements of fingers and toes, but rather to those controlling the larger joints. In a number of cases the observation was made that circulatory disturbances as shown by cold and clammy extremities were beneficially influenced in a comparatively short time. It is perhaps needless to say that exercise methods in infantile paralysis form but a part of the treatment. Massage, heat, supportive appliances, and operative procedures all have their proper place.

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## PLASTER ROPE CAST

### An Efficient Splint for Infected Fractures of the Leg

By ARCHIE EWING GORDIN, M.D., Jackson, Mississippi
Attending Surgeon, Mississippi State Charity Hospital

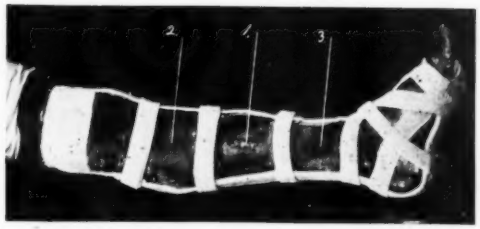
I HAVE endeavored for some time to find some form of plaster cast which could be used efficiently in such cases as compound infected fractures of the leg, certain osteomyelitis cases, and other conditions where immobility as well as drainage is required. I have used nearly every form of cast and splint, but recently on my service in the Mississippi State Charity Hospital I have been using a plaster cast composed of a number of plaster ropes, and have found this a most efficient splint in such cases.

The rope cast is made of six-inch plaster bandages. A bandage is folded upon itself several times, and is then folded lengthwise three times, so as to make a flattened plaster rope about 10 to 15 layers thick (see Fig. 1). These ropes are thus made strong enough to stand a considerable strain.

I usually mold one rope to the anterior surface of leg and one to the posterior surface, and at various intervals where there are no raw surfaces or discharging wounds, I wind plaster ropes around the leg. Usually about four ropes around the leg will hold it very firmly. Almost any modification can be made to suit individual case.

An ordinary plaster cast is not efficient in such cases, for even where an opening is cut in the cast, the discharge runs behind the plaster macerating the skin, and also softening the cast. The rope cast has answered very satisfactorily. I have been able to keep the leg very dry and clean, easy access to the wound is afforded, and it is possible to keep the leg well immobilized.

Figure 1 shows a cast made of plaster ropes which has been in place 5 weeks. It is in as good condition as when put on. This case was an acute infection of a compound fracture: the leg was




incised in four places, the incisions being between the plaster ropes as shown in the picture at *1*, *2*, *3*, and on the opposite side of leg. The original fracture was at *1*. The wounds healed and on removal of the cast, there was found good union of the bones. In this case the plaster ropes were reinforced with small steel wire. This cast is especially recommended for use in children.

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## BOOKS RECEIVED

Books received are acknowledged in this department and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

ANNALES DE LA CLINIQUE CHIRURGICALE DU PROFESSEUR PIERRE DELBET. No. 7—Fractures du Col du Fémur. By Antoine Basse. Paris: Librairie Félix Alcan, 1920.

LECCIONES CLÍNICAS DEL SÁBADO—LA LITIASIS BILIAR EN LA REPÚBLICA ARGENTINA. By Luis Agote. Buenos Aires: L. J. Rosso y Cia, 1920.

THE STORY OF THE AMERICAN RED CROSS IN ITALY. By Charles M. Bakewell. New York: The Macmillan Co., 1920.

HELPING THE RICH. By James Bay. New York: Brentano's, 1920.

BACKWATERS OF LETHE; SOME ANÆSTHETIC NOTIONS. By G. A. H. Barton, M.D. New York: Paul B. Hoeber, 1920.

SYPHILIS. By Loyd Thompson, Ph.B., M.D. 2d ed. thoroughly revised. Philadelphia and New York: Lea & Febiger, 1920.

THE SYSTEMATIC TREATMENT OF GONORRHŒA IN THE MALE. By Norman Lumb, O.B.E. 2d ed. Philadelphia and New York: Lea & Febiger, 1920.

SURGERY, ITS PRINCIPLES AND PRACTICE; for students and practitioners. By Astley Paston Cooper Ashhurst, A.B., M.D., F.A.C.S. 2d ed. Philadelphia and New York: Lea & Febiger, 1920.

SURGERY; A TEXTBOOK BY VARIOUS AUTHORS. Edited by George E. Gask, C.M.G., D.S.O., F.R.C.S.(Eng.), and Harold W. Wilson, M.S., M.B.(Lond.), F.R.C.S. (Eng.). London: J. & A. Churchill, 1920.

THERAPEUTISCHES VADEMEKUM FUER DIE KINDERPRAXIS. By Dr. Hans Kleinschmidt. Berlin: S. Karger, 1920.

DIE WURMFORTSATZENTZUENDUNG; eine pathogenetische und histologische Studie mit besonderer Berueecksichtigung der Bedeutung der Helminthen, speziell der Oxyuren, und wichtiger allgemeiner klinischer Gesichtspunkte. By Dr. A. Rheindorf. Berlin: S. Karger, 1920.

INJURIES OF PERIPHERAL NERVES. By Henry S. Souttar, C.B.E., F.R.C.S.(Eng.), M.Ch.(Oxon.), Major, ex.-R.A.M.C., and Edward W. Twining, M.R.C.S., L.R.C.P. (Lond.), Captain, ex-R.A.M.C. New York: William Wood & Co., 1920.

DEFECTS FOUND IN DRAFTED MEN; Statistical information compiled from the draft records showing the physical condition of the men registered and examined in pursuance of the requirements of the selective-service act. Prepared under the direction of the Surgeon-General, M. W. Ireland, Major General, M.C., U.S.A., by Albert G. Love, M.D., Major, M.C., U.S.A., and Charles B. Davenport, formerly Major, M.C., U.S.A. Washington: Government Printing Office, 1920.

BLOCK ANÆSTHESIA AND ALLIED SUBJECTS WITH SPECIAL CHAPTERS ON THE MAXILLARY SINUS, THE TONSILS, AND NEURALGIAS OF THE NERVUS TRIGEMINUS; for oral surgeons, dentists, laryngologists, rhinologists, otologists, and students. By Arthur E. Smith, D.D.S., M.D. St. Louis: C. V. Mosby Company, 1920.

VENEREAL DISEASES; THEIR CLINICAL ASPECT AND TREATMENT. J. E. R. McDonagh, F.R.C.S. St. Louis: C. V. Mosby Co., 1920.

COLLECTED PAPERS OF THE MAYO CLINIC, ROCHESTER, MINNESOTA. Edited by Mrs. M. H. Mellish. Vol. XI, 1919. Philadelphia and London: W. B Saunders Co.

THE ENDOCRINES. By Samuel Wyllis Bandler, A.B., M.D., F.A.C.S. Philadelphia and London: W. B. Saunders Co., 1920.

THE FORM AND FUNCTIONS OF THE CENTRAL NERVOUS SYSTEM: an introduction to the study of nervous diseases.

By Frederick Tilney, M.D., Ph.D., and Henry Alsop Riley, A.M., M.D. New York: Paul B. Hoeber, 1920.

PSYCHOPATHOLOGY. By Edward J. Kempf, M.D. St. Louis: C. V. Mosby Co., 1920.

CLINICAL LECTURES ON ENLARGEMENT OF THE PROSTATE; with a description of the author's operation of total enucleation of the organ. By Sir Peter J. Freyer, K.C.B., M.D., M.Ch., M.A., LL.D.(honoris causa) Nat. U. I.

TRANSACTIONS OF THE SOUTHERN SURGICAL ASSOCIATION. XXXII, 1919. Edited by H. A. Royster, M.D., 1920.

NITROUS OXIDE-OXYGEN ANALGESIA AND ANÆSTHESIA IN NORMAL LABOR AND OPERATIVE OBSTETRICS. Edited by F. H. McMechan, M.D. Published by National Anæsthesia Research Society, 1920.

SURGICAL PATHOLOGY AND MORBID ANATOMY. By Sir Anthony A. Bowlby, K.C.B., K.C.M.G., K.C.V.O., F.R.C.S., and Sir Frederick W. Andrewes, M.D., F.R.S. 7th ed. Philadelphia: P. Blakiston's Son & Co.

THE ANATOMY OF THE HUMAN SKELETON. By Ernest Frazer, F.R.C.S.(Eng.). 2d ed. Philadelphia: P. Blakiston's Son & Co., 1920.

ANÆSTHETICS; THEIR USES AND ADMINISTRATION. By Dudley Wilmot Buxton, M.D., B.S. 6th ed. Philadelphia: P. Blakiston's Son & Co., 1920.

REPORT OF THE SURGEON GENERAL, U. S. ARMY, TO THE SECRETARY OF WAR, 1920.

MORTALITY STATISTICS, 1919. Bulletin No. 144—Department of Commerce, Bureau of the Census, Sam. L. Rogers, Director. Washington, 1920.

THE DIFFICULTIES AND EMERGENCIES OF OBSTETRIC PRACTICE. By Comyns Berkeley, M.A., M.D., M.C. (Cantab.), F.R.C.P.(Lond.), F.R.C.S.(Eng.), and Victor Bonney, M.S., M.D., B.Sc.(Lond.), F.R.C.S.(Eng.), M.R.C.P.(Lond.). 3d ed. Philadelphia: P. Blakiston's Son & Co., 1921.

PROCEEDINGS OF THE FOURTEENTH ANNUAL MEETING OF THE ASSOCIATION OF LIFE INSURANCE PRESIDENTS, New York, December 9 and 10, 1920.

TRANSACTIONS OF THE NINETEENTH, TWENTIETH, AND TWENTY-FIRST ANNUAL MEETINGS OF THE AMERICAN PROCTOLOGIC SOCIETY, New York, June 4 and 5, 1917; Atlantic City, June 7 and 9, 1919; and Memphis, April 22 and 23, 1920.

UNITED STATES NAVAL MEDICAL BULLETIN. Published for the Information of the Medical Department of the Service. Mare Island Hospital Number, January, 1921.

OEDEMA AGUDO O SUBAGUDO DEL BRAZO (Thrombosis Venosa por Esfuerzo). By Alejandro J. Pavlovsky, 1920.

SURGICAL THERAPEUTICS AND OPERATIVE TECHNIQUE. By E. Doyen. English edition prepared by the author in collaboration with H. Spencer-Browne, M.D.(Cantab.), etc. Vols. II and III. London: Bailliére, Tindall & Cox, 1920.

A SYNOPSIS OF SURGERY. By Ernest W. Hey Groves, M.S., M.D., B.Sc. (Lond.), F.R.C.S.(Eng.). 5th ed. New York: William Wood and Co., 1920.

SURGERY OF THE LUNGS AND PLEURA. By H. Morriston Davies, M.A., M.D., M.C.(Cantab.), F.R.C.S.(Eng.)., Hon. Captain, R.A.M.C.(T.). New York: Paul B. Hoeber, 1920.

DISEASES OF THE EAR. By Philip D. Kerrison, M.D. 2d ed. Philadelphia and London: J. B. Lippincott Co., 1920.

# BOOK REVIEWS

## A CRITIQUE OF NEW BOOKS IN SURGERY

SURELY the axiom "Qui excuse s'accuse" does not hold good for the reviewer who prefaces a critique of two admirable historical volumes with an apology for including them in a general discussion devoted to purely surgical volumes. 'Tis true, and pity is 'tis true that to most of us medical history is caviar, when it really should be mother's milk. Culture, poise, polish, and perspective—all highly desirable attributes—may be won in many and diverse ways; but the medical man may write it down as certain that in no surer fashion can he make these virtues his own than by knowing the intimate history of his guild.

Such thoughts are inspired by the recent perusal of two volumes—one devoted to the history of anatomic illustration,[1] and the other to the life of Paracelsus.[2]

*The History and Bibliography of Anatomic Illustration* is in the nature of a memorial edition. The editor, the late Dr. Mortimer Frank, so well known for his contributions to medical history, died before his manuscript was set up in type. A memorial committee saw to it that the book did not die aborning; and more than this, two pre-eminently qualified members of the committee have graced the volume with two additional chapters.

The introductory chapter by the editor is devoted to a short life of Choulant. Due to a highly refined sense of selection on the part of Dr. Frank, this chapter relates not only the historical achievements and bias of Choulant, but also his relationships to the development of medicine during the early nineteenth century. Choulant was contemporaneous with Sprengel, Blumenbach, Littré, Daremberg, and Wunderlich. Dr. Frank, in the compass of a few pages, relates most entertainingly the development of the old medicine into the new, with Choulant unhappily buttressing the outworn, and opposing the new and ultimately victorious, doctrines. The meat of this chapter should be part and parcel of the consciousness of every medical man.

The rest of the volume, which is more academic in character and which makes therefore a less direct appeal to the casual medical reader, is devoted to short biographic and bibliographic notes on the various anatomists and artists who have contributed to the development of the illustrative and artistic side of anatomy. The illustrations, abundant in number, are all taken from such inaccessible sources, that they make a unique appeal; and the academic thoroughness which characterizes practically every line of type makes the book a prize possession even for him who may claim no place among the cognoscendi.

In addition to all this Dr. Fielding H. Garrison and Dr. Edward H. Streeter have added a chapter on "Sculpture and Painting as Modes of Anatomical Illustration," which vies in method of handling with the work of Choulant himself. Finally Dr. Garrison contributes a closing chapter on "Anatomical Illustration since the Time of Choulant," which is a gem of thoroughness lightened here and there with short, clear, cameo-cut explanatory notes.

The reviewer's best wish for the New Year is that a renaissance of historical taste will occur, Minerva-like, and result in the demand for a second and then further editions of this valuable book.

The *Paracelsus* by Stillman is a different sort of a volume. Most of us know old Bombastus, and never tire of reading of his conflicts, polemics, and perigrinations. We read Stillman's version with interest because he has parceled out his material so lucidly and rationally.

Dr. Stillman, himself a chemist and not a physician, has seen to it that full exposition is made of the work of Paracelsus in the field of chemistry; but with admirable restraint and a very fitting sense of proportion this is not unduly stressed. Indeed, little more is said about Paracelsus' accomplishments in the field of chemistry than about his views on theology or pertaining to the ethics of medicine.

The book is entertainingly written; its authoritative character is vouched for by the fact that Stillman has followed very closely the painstaking researches of Schubert and Sudhoff, Huser, and Hartmann. Withall, however, the author practices independent judgment sufficiently often to rob the work of that deadly stupor which only too often characterizes the simple rehash of authoritative statements.

The mere facts that Paracelsus has been immortalized by Browning, has been credited with creating modern surgery, has been dubbed the father of Natural Philosophy, has been supposed to be the inspirer of Goethe's *Faust*, and will always

[1] HISTORY AND BIBLIOGRAPHY OF ANATOMIC ILLUSTRATION IN ITS RELATION TO ANATOMIC SCIENCE AND GRAPHIC ARTS. By Ludwig Choulant. Translated and edited by Mortimer Frank, B.S., M.D. Chicago: University of Chicago Press, 1920.

[2] THEOPHRASTUS BOMBASTUS VON HOHENHEIM CALLED PARACELSUS; HIS PERSONALITY AND INFLUENCE AS PHYSICIAN, CHEMIST, AND REFORMER. By John Maxson Stillman. Chicago and London: The Open Court Publishing Co., 1920.

(rightly or wrongly) be credited with being the arch mystic—all these should inspire even the busy practitioner to want to thumb through this little volume.

M. G. SEELIG, M D.

DR. BOSCH ARANA'S book[1] is an exhaustive historic, experimental and clinical exposé of cineplastic amputations and an accurate analysis of the many more or less successful attempts to "vivify" artificial limbs. The author is to be commended for his absolute sincerity as well as his modesty. He frankly gives full credit to Dr. Guiliano Vanghetti, of Empoli, Italy, for his original description of cineplastics in 1898; and, in the main, follows the technique of Pellegrini, of Florence, or that of Sauerbruch. The author's personal contribution to this important subject consists in a detailed report of twenty clinical cases, a description of various modifications in operative technique and a presentation of extremely ingenious mechanical hands and feet capable, so he states, of being vivified by muscle traction.

Particularly striking, however, is the extraordinary patience and perseverence manifested by surgeon and patient to obtain a more or less dependable cineplastic contraction of from 1 to 3 centimeters! Dr. Bosch Arana's attempts to obtain alternating flexor and extensor traction in his cineplastic motors must necessarily arouse skepticism; from a purely physiological viewpoint, this desideratum would seem impossible of attainment.

Among his "conclusions" are the following which are well worth remembering:

1. The epidermization of a cineplastic motor is a problem which has not yet been satisfactorily or conclusively solved.

2. Cineplastic motors should be either of the club or ring types; the former is more apt to epidermize satisfactorily.

3. In the present state of cineplastic surgery, the sacrifice of an articulation in order to obtain a motor club or ring is unjustifiable.

4. Immediate prevention of muscle retraction (of an amputated limb) is of no practical advantage; postoperative measures having the same object in view are of great value.

The work is manifestly that of an enthusiast who has devoted an immense amount of time and thought to a subject which has been given a new impulse through war mutilations.

Dr. Bosch Arana's book can be highly recommended to surgeons who wish to study the subject of cineplastic amputations. Both descriptive technique and illustrations are excellent; a series of moving-picture photographs enable the reader to follow the results obtained in some of the author's cases. Finally, the Spanish language should offer no difficulties to the surgeon whose Latin groundwork has not been neglected.

GEORGE DE TARNOWSKY, M.D.

[1] LAS AMPUTACIONES CINEPLASTICAS By Dr. Guillermo Bosch Arana, Buenos-Aires, 1920.

A VALUABLE collection of personal cases operated upon and exhaustively analyzed by the author and his pupils is found in *Clinica Quirurgica y Tecnica Operatoria.*[2] Of special interest may be mentioned 15 cases of tropical abscess of the liver with 14 cures and 1 death from hepatic insufficiency. Classical drainage of the abscess via either the anterior or transpleural routes is followed by the administration of 4 to 6 centigrams of emetine hydrochloride hypodermatically and of an equal quantity into the abscess cavity itself; the combined doses are repeated daily for 6 days, followed by an interval of 1 week or more. This technique, according to the author, avoids the appearance of the peripheral neuritides reported by various clinicians and is a departure from the Roger treatment (*Journal de Chirurgie*, May, 1914), which simply consisted in aspiration of the abscess followed by the injection of from 6 to 10 centigrams of emetine hydrochloride in 30 to 40 cubic centimeters of sterile water.

For operations on the liver and biliary passages, the author describes his own incision, based on anatomical grounds, which avoids injuring the costal nerves. Beginning slightly below the ensiform appendix, he makes a vertical incision, 8 centimeters long, through the linea alba then arches upwardly and outwardly toward the tenth costal cartilage. He claims that the second part of his incision parallels both nerves and intercostal arteries, thus avoiding both.

Three personal cases of pseudomyxoma of the peritoneum of appendicular origin, are reported, corresponding in type to the morbus gelatinosus peritonei of Péan. In his opinion, a pre-operative diganosis of this curious pathological condition is well-nigh impossible to make.

An interesting case of fibrosarcoma of the ovary in a ten-year old girl, with no metastases 4 years after operation, bears out the well-known fact that neoplasms of the ovary are readily curable by operation.

There are chapters devoted to chronic pancreatitis of biliary origin diagnosed by the Gammidge test, acute perforations of gastric ulcer, ureterorenal lithiasis, extirpation of an axillary aneurism (the author's case was really not an aneurism but a traumatic hæmatoma following a gunshot wound of the axilla), and anatomic researches in deep vasculonervous surgery of the neck. The bibliography is extensive and the illustrations are unusually good.

GEORGE DE TARNOWSKY, M.D.

THE development of neurological surgery has steadily progressed during the past decade. The rough, uncouth surgery that characterized its early stages is rapidly giving place to procedures carefully studied from anatomical and physiological groundwork. Those who are called upon to deal with this branch of specialized surgery

[2] CLINICA QUIRURGICA Y TECNICA OPERATORIA. By Dr. J. A. Presno y Bastiony, Professor of Anatomy, National University Medical School: Surgeon to the Covadonga Clinic, etc. etc. Havana, Cuba: 1920.

will be especially interested in the Tandler-Ranzi[1] concise monograph of 150 pages dealing with surgery of the brain and spinal cord. The co-authorship of Tandler, professor of anatomy at the University of Vienna, and Ranzi, professor of surgery in the same university, has resulted in a most excellent contribution. The anatomical drawings under the supervision of Tandler have been reproduced in a beautiful manner. The illustrations, many of them in colors, are illuminating and exact. From the book-making standpoint the volume will stand without a superior. The monograph includes an excellent bibliography.

In only one particular will the American surgeon feel that the contribution of his confrères has been neglected and that is in the short description only of resection of the sensory root for trifacial neuralgia, a procedure that with us has largely displaced the more dangerous and no more efficient procedure of removal of the ganglion.

FEW of the profession realize the scope of the more recent branch of medicine known as industrial medicine and surgery. Many physicians believe that to be able to treat an open wound or infection, to reduce a fracture or perhaps to relieve a poisoning case, constitute the greater portion of industrial medicine and surgery. The purely medical or surgical technique displayed in this branch of work is perhaps only 50 per cent of the total obligation. Prophylaxis, which we are taught in medicine and surgery, finds its greatest function in industrial practice. The physician's effort in preventing accident and disease is probably the first phase of his duty.

Routine examination of employees to determine the physical fitness of each and to detect disabilities which would subject the individual to extra hazards, is equally important. Close association between the physician and the safety expert is necessary. Few employers realize that the human body is in reality a highly organized and intelligent machine, which needs supervision in order to maintain maximum efficiency. This maximum efficiency is only obtained from an employee who is physically and mentally fit, and is relieved of any degree of family worries. Consequently the work must of necessity be carried to the home in order to be of greatest benefit. Contagious and infectious diseases among employees is a problem in itself. This leads to the consideration of industrial hygiene and sanitation.

These various elements and constituents of industrial medicine and surgery along with many others are ably treated by Mock[2] in his recent work. There has been a long-felt want for such a treatise; something to guide not only the physician but the employer, the sanitary expert, the safety engineer, and the social service worker.

The text is divided into six chapters, devoted respectively to industrial health service, prevention, industrial medicine, industrial surgery, compensation insurance, medicolegal phases, and reconstruction.

This work should be carefully studied by the physician treating employees in industrial pursuits. It is no less valuable to the employer, upon whom depends to a marked degree the responsibility of putting such an elaborate and economic principle into practice, and by the casualty companies who must yet be taught the crucial lesson that a laborer is a human being, deserving intelligent and skillful medical and surgical attention. J. A. W.

EVERY consulting surgeon realizes the comparative lack of knowledge of the average practitioner regarding diseases of the rectum and anus, and can recall many instances when he has been asked to operate upon a case of hæmorrhoids and has found an existing or far advanced carcinoma. Many of these patients have been operated upon once and at times twice before for so-called hæmorrhoids. On the contrary many unscrupulous men capitalize the so-called "specialty"—diseases of the rectum—and pretend to cure everything from epilepsy to dementia præcox by operating upon, and by treating the anus. This is again more or less directly the result of the ignorance of the average physician regarding diseases of this location. If every physician possessed a fair knowledge of the pathology of this region and put it into practice much of this abuse would cease.

The new edition of Hirschman[3] again brings to the attention of the profession the necessity for careful and routine examination of the rectum and anus. In a sane and concise manner, the author gives an analysis of the diseases about the anus. The text is confined chiefly to diagnosis and those forms of treatment which can be carried out without the use of a general anæsthetic. The present edition elaborates somewhat on work which can be done under local anæsthesia.

It seems to the reviewer that the outstanding idea expressed in the monograph is that a rectal examination should be included in all routine examinations and when such findings warrant, further specific examinations should be made. J. A. W.

INJURIES to the lung and pleura have received much attention during the recent war, the forms of treatment varying in either extreme, viz., expectant treatment and radical thoracotomy with delivery of the lung for operative procedure, the mortality statistics varying very materially with each form of treatment in the hands of various observers. With this in view the methods and re-

[1] CHIRURGISCHE ANATOMIE UND OPERATIONSTECHNIK DES ZENTRALNERVENSYSTEMS. By Dr. J. Tandler and Dr. E. Ranzi. Berlin: Verlag von Julius Springer, 1920.

[2] INDUSTRIAL MEDICINE AND SURGERY. By Harry E. Mock, B.S., M.D., F.A.C.S., Philadelphia and London: W. B. Saunders Company, 1920.

[3] HANDBOOK OF DISEASES OF THE RECTUM. By Louis J. Hirschman, M.D., F.A.C.S. 3d ed., revised and rewritten. St. Louis: C. V. Mosby Co., 1920.

sults of Morelli[1] who had charge of all chest injuries in the 11th Corps of the Italian Army, are of the greatest interest.

In a recent monograph Morelli strikes a key-note in lung and chest surgery. The methods of treatment are the result of a careful study of the physiology of the lung, pleura, and chest wall, as well as the symptoms, produced by injuries to these organs. As the author states in the preface "Accuracy of diagnosis is of fundamental importance in the value of statistics," so it is with the form of treatment to be instituted.

The accurate description of the physiology of the lung, chest wall, and mediastinum, during the act of breathing surely paves the way for a clear understanding of the methods of treatment given later.

The fundamental principles of the treatment advocated and used by Morelli can be expressed very briefly. A lung which is completely collapsed and at rest, will not bleed, will take care of an unusual amount of infection and will heal promptly. To put a lung completely at rest it must be collapsed. The ideal way to collapse a lung completely is to perform a pneumothorax. In order to maintain a pneumothorax, an open wound of the chest wall must be closed. About these few facts Morelli constructs his method of treatment.

The basic principles were evolved by the late Professor Forlanini in his work on artificial pneumothorax for the treatment of pulmonary tuberculosis and pleurisy, and Morelli, his assistant, has applied them to the treatment of surgical conditions of the lung and pleura.

[1] The Treatment of Wounds of Lung and Pleura Based on a Study of the Mechanics and Physiology of the Thorax. Artificial Pneumothorax, Thoracentesis, Treatment of Empyema. By Professor Eugenio Morelli. Translated by Lincoln Davis and Frederick C. Irving. Boston: W. M. Leonard, 1920.

The author gives a detailed description of the physiology of the mechanics of the chest, careful description of the symptoms of lung and pleural injuries and then a minute and careful explanation of the technique of treatment. This is followed by 65 case histories with X-ray pictures and discussion.

Morelli has certainly presented this class of injuries in a new light, and from his unusual results, one is persuaded that his methods are sound, even more, that his methods have no peer, at least at the present time. J. A. W.

TO those who read Italian this monograph[2] presents a mass of facts and authorities which make it practically unnecessary to search current literature for details concerning hernia.

The author divides his subject into eight sections devoted respectively to the history of the radical cure for hernia, operative procedures, indications for operation, the operative procedure in adolescence and late infancy, the operative cure in early infancy, personal clinical observations, general considerations and a résumé of the important facts concerned in the pathogenesis, pathological anatomy, symptomatology, and operative cure

The monograph is of chief value probably in that it contains a rather unusual amount of statistical data ready to hand, and in that it furnishes a rather comprehensive view of the subject, owing to the orderly, logical, and detailed fashion in which the author develops the various chapters topic by topic

All readers, other than those unusually well versed in Italian will lament the absence of illustrations. The very feel of the wonderfully heavy glazed pages is a constant reminder of what pencil and brush might have added. M. G. S.

[2] L'Ernia Inguinale Nell' Infanzia. By Prof. Gerolamo Gatti. Bologna and Trieste: L. Capelli, Editore, 1920.

# CORRESPONDENCE

## MANAGEMENT OF CERVICAL STUMP AND ROUND LIGAMENTS

*To the Editor*: In your issue of December, 1920, there appeared an article written by me entitled "Management of the Cervical Stump and the Round Ligaments, etc.," in which there are two illustrations of a sagittal section of the female pelvis. These illustrations were taken from casts which were made at Bellevue Hospital, New York, from a dissected, not frozen, body, by a Belgian artisan, under the direction of H. D. Senior, professor of anatomy, and Dr. S. Brock. The illustrations as they appear are the result of the work of an artist P. L. Bissell, done on the photographs of these casts.

At the time the illustrations were published, I was not aware of the fact that any other than an expert artisan at the Bellevue Hospital was concerned in the making of these casts, and was under the impression that he made them to sell to students of medicine. Soon after the December number of SURGERY, GYNECOLOGY AND OBSTETRICS was issued, I received a letter from Dr. William E. Studdiford telling me of the origin of these casts, and I am writing this, in order to give credit to Dr. William E. Studdiford at whose suggestion the casts were made, and to Prof. H. D. Senior, and Dr. S. Brock, who dissected the subject and supervised the modelling of the cast.

DOUGAL BISSELL, M.D., F.A.C.S.

NEW YORK.

## BILATERAL RENAL DYSTOPIA

*To the Editor:* In the January, 1921, issue of SURGERY, GYNECOLOGY AND OBSTETRICS, I read with much interest, an article entitled "Bilateral Renal Dystopia" by Dr. H. W. E. Walther. A statement in it regarding the surgical replacement of the dystopic kidney demands of me a reply. The statement to which I refer is that "Transplantation of the dystopic kidneys has been attempted from time to time, but with little success etc." The author cites one authority only, *i.e.* Munroe, *Boston Medical and Surgical Journal*, 1910, clxii, who refers to a number of cases in which the kidney was transplanted, but where nephrectomy was required later on. It is to be inferred that Dr. Walther is of the opinion that the attempts to transplant the dystopic kidney have never succeeded.

May I call the attention of your readers to the fact that the dystopic kidney has been successfully transplanted in three individual cases. In one of these cases the kidneys were fused and occupied the greater portion of the true pelvis. This case was presented in an article read before the American Gynecology Society, in 1911, entitled "The Pelvic Kidney," and published in the *American Journal of Obstetrics and Diseases of Women and Children*, October, 1911. Permit me briefly to sketch some of the salient features of the case. The fused organ formed a very large mass, situated in the right pelvic region, and occupying the greater portion of the true pelvis. It extended beyond the middle line and reached from the base of the broad ligament to the abdominal wall, appearing there as a large tumor of the lower abdomen.

To transplant this great mass, which not only prevented the uterus from assuming its anterior position, but obstructed almost completely the pelvic passage, it was necessary to sacrifice the artery and vein which terminated at the lower hilum. The severing of these vessels permitted me to lift the fused mass out of the true pelvis, and shift it to the region of the false pelvis where I successfully anchored it according to a technique first published July, 1910, in SURGERY, GYNECOLOGY AND OBSTETRICS. This patient married about 6 months later, became pregnant twice, and was delivered normally. I have had several X-rays taken since her confinement and they have shown the fused kidney to be in position anchored. Had pregnancy occurred previous to operation, development of the uterus would have been impossible, as the body of the uterus was held in a retroposed position by the fused organs. Had it been possible to have forced the body of the uterus forward, and had pregnancy then occurred, the passage of a child through the canal would have been impossible. Another feature of this case of particular interest is the fact that though the two main vessels leading to the lower, or what should have been the left kidney, were severed, and all direct arterial supply to it cut off, and that this lower segment or left kidney was not functioning at the time the patient left the hospital several weeks after the operation, this segment did eventually function normally, recovering its entire blood supply through renal anastomosis from the upper fused segment.

DOUGAL BISSELL, M.D., F.A.C.S.

NEW YORK.

# AMERICAN COLLEGE OF SURGEONS

## STATE AND PROVINCIAL CLINICAL SECTIONS

During the month of January, the first annual meetings of the Texas, Louisiana, Mississippi, Alabama, Florida, Georgia, North Carolina, and South Carolina Clinical Sections of the Clinical Congress of American College of Surgeons were held. In addition to the general plan heretofore followed a conference on hospital standardization was called to meet on one day of the session. To this conference hospital superintendents, trustees of the hospitals, and nurses were invited. Papers were read giving the points of view of the surgeon, the hospital superintendent, and others interested in the hospital, on the standardization program which has been outlined by the College. This was followed by a general discussion in order to make clear the practical application of the minimum standard. This new feature proved a decided success.

The programs for the different sections follow.

### TEXAS

Texas held its first clinical meeting January 7 and 8, with headquarters at the Adolphus Hotel, Dallas. Operative clinics and clinical demonstrations were given each forenoon at the Baptist Memorial Sanitarium, St. Paul Sanitarium, and Parkland Hospital.

HOSPITAL CONFERENCE

Hospital Program of the American College of Surgeons, Franklin H. Martin, M.D., Secretary-General, American College of Surgeons, Chicago
The Soul of Standardization, Rev. C. B. Moulinier, S. J., President, Catholic Hospital Association, Milwaukee, Wisconsin
The Work of the Hospital Surveyor, James L. Smith, M.D., Hospital Survey Department, American College of Surgeons
Experience with the Standardization Program of the American College of Surgeons from the Surgeon's Standpoint. Arthur Carroll Scott, M.D., Senior Surgeon, Temple Sanitarium
Experience with the Standardization Program of the American College of Surgeons from the Hospital Superintendent's Standpoint. J. B. Franklin, Superintendent, Baptist Memorial Sanitarium, Dallas, Texas
The Meaning to the Layman of the Minimum Standard. Judge Harold M. Stephens, Director of Hospital Activities, American College of Surgeons
Discussion led by W. B. Russ, San Antonio

2:30 P.M., FRIDAY, JANUARY 7

Organization for Better Surgery, Franklin H. Martin, M.D., Chicago
Discussion of Cases Presented at Morning Clinics

8:00 P.M., FRIDAY, JANUARY 7—PUBLIC MEETING

Address of Welcome, Palmer Brooks, LL.D., President, Baylor University, Waco
The American College of Surgeons, Franklin H. Martin, M.D., Chicago
The Control of Cancer, Thomas Stephen Cullen, M.D., Professor of Gynecology, Johns Hopkins University, Baltimore
Better Hospitals, Rev. C. B. Moulinier, S. J., Milwaukee, Wisconsin
The Standardization of Hospitals, Judge Harold M. Stephens, Chicago

2:30 P.M., SATURDAY, JANUARY 8

Treatment of Cancer, Thomas Stephen Cullen, M.D., Baltimore
Discussion of Cases Presented at Morning Clinics

### LOUISIANA AND MISSISSIPPI

The Louisiana and Mississippi State Sections met jointly, January 10 and 11, with headquarters at the Grunewald Hotel, New Orleans. During the forenoon of each morning clinics were given at the Charity Hospital, Touro Infirmary, Presbyterian Hospital, Hôtel Dieu, and Eye, Ear, Nose, and Throat Hospital.

At the Hospital Conference in addition to the addresses by Dr. Martin, the Rev. Moulinier, Dr. Smith, and Judge Stephens, Dr. S. M. D. Clark, of New Orleans, read a paper on "Experience with the Standardization Program of the American College of Surgeons from the Surgeon's Standpoint," and Dr. Tipping, Superintendent of the Touro Infirmary, on "Experience with Standardization Program of the American College of Surgeons from the Hospital Superintendent's Standpoint."

8:00 P.M., MONDAY, JANUARY 10—PUBLIC MEETING

Address of Welcome, John M. Parker, Governor of Louisiana
The American College of Surgeons, Franklin H. Martin, M.D., Chicago
Better Hospitals, Rev. C. B. Moulinier, S. J., Milwaukee, Wisconsin

Cancer, and What the Public Can Do for It. Thomas Stephen Cullen, Professor of Gynecology, Johns Hopkins University, Baltimore
The Standardization of Hospitals. Judge Harold M. Stephens, Chicago

2:30 P.M., TUESDAY, JANUARY 11

Résumé of Monday and Tuesday Clinics
Organization for Better Surgery. Franklin H. Martin, M.D.
Weak Spot in American Surgery, Thomas Stephen Cullen, M.D.

ALABAMA, FLORIDA, AND GEORGIA

On January 14 and 15, Alabama, Florida, and Georgia met jointly at Atlanta, Georgia, with headquarters at the Piedmont Hotel. During the mornings from 9 a. m. to 1 p. m., clinics were held at the Grady Hospital, St. Joseph's Infirmary, Georgia Baptist Hospital, Wesley Memorial Hospital, The Gray Clinic, Piedmont Sanatorium, Noble's Infirmary, and the Davis-Fischer Sanatorium.

At the Hospital Conference at the Piedmont Hotel on January 14, in addition to addresses given by Dr. Martin, the Rev. Moulinier, Dr. Smith and Judge Stephens, Dr. R. M. Harbin, of Rome, Georgia, spoke on "Experience with the Standardization Program of the American College of Surgeons from the Surgeon's Standpoint."

2:30 P.M., FRIDAY, JANUARY 14

Organization for Better Surgery, Franklin H. Martin, M.D., Chicago
The Differential Diagnosis of Acute Infections of the Kidneys, James N. Baker, M.D., Montgomery, Alabama
Gastric and Duodenal Ulcers, C. C. Harrold, M.D., Macon, Georgia
Infections from Appendix, Cunningham Wilson, M.D., Birmingham, Alabama

8:00 P.M., FRIDAY, JANUARY 14—PUBLIC MEETING

Invocation, Dr. H. W. Cox, President, Emory University
Address of Welcome, Hon. James L. Key, Mayor of Atlanta
Address of Welcome, Hon. T. W. Hardwick, Governor-Elect of Georgia
The American College of Surgeons, Franklin H. Martin, M.D.
Better Hospitals, Rev. C. B. Moulinier, S.J., Milwaukee, Wisconsin
Economic Value to Community of Prenatal Work, John Osborn Polak, M.D., Professor of Gynecology and Obstetrics, Long Island College Hospital, Brooklyn
Standardization of Hospital, Judge Harold M. Stephens
Cancer, Joseph C. Bloodgood, M.D., Associate Professor of Clinical Surgery, Johns Hopkins Hospital, Baltimore

2:30 P.M., SATURDAY, JANUARY 15

What May Be Expected by Newer Methods of Cæsarean Section, John Osborn Polak, M.D., Brooklyn
The Recognition of Breast Lesions at Exploratory Incision, Joseph C. Bloodgood, M.D., Baltimore
Tribute to Dr. Crawford W. Long, Frank K. Boland, M.D., Atlanta
Inhalation Anæsthesia, George R. White, M.D., Savannah
Local and Regional Anæsthesia, H. P. Cole, M.D., Mobile
Spinal Anæsthesia, John F. Denton, M.D., Atlanta
Anoci-Association, L. Sage Hardin, M.D., Atlanta

SOUTH CAROLINA

The South Carolina State Clinical Section met in Charleston, January 17 and 18, with headquarters at the New Charleston Hotel. Clinics were held each morning at the Roper Hospital, St. Francis Xavier Infirmary, and Baker Sanitarium. On January 17, 1921, at 9 a. m. the hospital conference met in the Banquet Room of the New Charleston Hotel. Papers were read by the Rev. C. B. Moulinier, S. J., Dr. James L. Smith, Judge Harold M. Stephens, in addition to addresses on "Experience with the Standardization Program of the American College of Surgeons from the Surgeon's Standpoint," by Robert S. Cathcart, M.D., Charleston, and "Experience with the Standardization Program of the College, from the Hospital Superintendent's Standpoint," by Kenneth M. Lynch, Board of Commissioners, Roper Hospital.

2:30 P.M., MONDAY, JANUARY 17

What May Be Expected from the New Methods of Cæsarean Section, by John Osborn Polak, M.D., Brooklyn
The Importance of Certain Mastoid and Lateral Sinus Infections Often Mistaken for Commoner Atypical General Infections, J. Wilkinson Jervey, Greenville
Discussion of Clinics

8:00 P.M., MONDAY, JANUARY 17—PUBLIC MEETING

Address of Welcome, Hon. John P. Grace, Mayor of Charleston
Better Hospitals, Rev. C. B. Moulinier, S.J., Milwaukee, Wisconsin
Economic Value to Community of Prenatal Work, John Osborn Polak, M.D., Brooklyn
The Standardization of Hospitals, Judge Harold M. Stephens, Chicago
How People of South Carolina Can Co-operate with the American College of Surgeons, John G. Clark, M.D., Professor of Gynecology, University of Pennsylvania Medical School, Philadelphia
The Menace of Cancer, Joseph C. Bloodgood, M.D., Baltimore

2:30 P.M., TUESDAY, JANUARY 18

Chronic Endocervicitis, A. E. Baker, M.D., Clinical Professor of Abdominal Surgery and Gynecology, Medical College, State of South Carolina, Charleston
Surgical Kidney, E. C. Baynard, M.D., Professor of Urology. Medical College, State of South Carolina, Charleston
Discussion of Clinics

### NORTH CAROLINA

The North Carolina State Clinical Section met in Charlotte, January 20 and 21, with headquarters at the Hotel Selwyn. During the forenoon of each day clinics were held at the various hospitals.

#### 2:30 P.M., THURSDAY, JANUARY 20

Removal of Ureteral Stones by Cystoscopic Manipulation, A. J. Corwell, M.D., Charlotte
Pelvic Inflammatory Diseases, N. D. Bitting, M.D., Durham
The Acute Pelvis, E. T. Dickinson, M.D., Wilson
Urinary Findings in the Acute Abdomen, H. F. Long, M.D., Statesville
Pancreatitis, John B. Deaver, M.D., Philadelphia
Discussion of Clinics and Papers

#### 8:00 P.M., THURSDAY, JANUARY 20—PUBLIC MEETING

Invocation, Rev. A. A. McGeachy, Pastor Second Presbyterian Church
Report of Committee on Arrangements. Andrew J. Crowell, M.D.
Address of Welcome and Introduction of Hon. Cameron Morrison, Governor of North Carolina, John P. Munroe, M.D.
Menace of Cancer, John G. Clark, M.D., Philadelphia
The Relation of the Public to the Medical Profession, W. S. Rankin, M.D., President, American Public Health Association, Raleigh
Economic Value to the Community of Prenatal Work, John Osborn Polak, M.D., Brooklyn
Better Hospitals, Rev. C. B. Moulinier, S.J., Milwaukee, Wisconsin.
The Mission of the American College of Surgeons, J. M. T. Finney, M.D., Chief Surgeon, Johns Hopkins Hospital, Baltimore
Health, the Community's Responsibility, John B. Deaver, M.D., Philadelphia
The Standardization of Hospitals, Judge Harold M. Stephens
Address, Governor Morrison

#### 2:30 P.M. FRIDAY, JANUARY 21

Actinomycosis of Cæcum with Report of Two Cases, F. Webb Griffith, M.D., Asheville
Intussusception of Ileum in Adults Due to Benign Tumors, M. H. Biggs, M.D., Rutherfordton
Abdominal Cæsarean Section for Eclampsia, B. C. Willis, M.D., and E. S. Boice, M.D.
Symposium—Mastoid Disease
When to Operate on a Mastoid, J. G. Murphy, M.D., Wilmington
Complications Following Mastoiditis, H. H. Briggs, M.D., Asheville
A Statistical Study Bearing upon the Value of the Conserved Ovary in Cases of Hysterectomy, John G. Clark, M.D., Philadelphia
Discussion of Clinics and Papers, H. A. Royster, M.D.

At the Hospital Conference held in the forenoon of January 20, in addition to the addresses by the Rev. C. B. Moulinier, S. J., Dr. Smith, and Judge Stephens, addresses on "Experience with the Standardization Program of the American College of Surgeons from the Surgeon's Standpoint" were given by Dr. J. Wesley Long, of Greensboro, and on "Hospital Staff Meetings," by John B. Deaver, M.D., Philadelphia.

### MEETINGS SCHEDULED TO BE HELD

Iowa—Des Moines, February 28 and March 1.
Nebraska—Omaha, March 3 and 4.
Kansas—Wichita, March 7 and 8.
Missouri—St. Louis, March 10 and 11.
Tennessee—Nashville, March 21 and 22.
Kentucky—Louisville, March 25 and 26.